THE

JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

VOL. XVII. No. 410—20th YEAR.] LONDON, JULY 7, 1868. [Subscription per Ann. { 15s. in Advance / 18s. Credit.] DOUBLE No. Price 1s.

RAMSAY'S NEWCASTLE CANNEL
COAL. Analysis by Dr. FYFE, M.D.:—
9746 cubic feet of gas per ton of coal.
26-candle gas.
13¼ cwt. coke per ton of coal.
N.B.—Ramsay's Cannel most resembles the Marquis of Lothian's Cannel, but superior as to coke.
RAMSAY'S PATENT CONDENSED COKE,
DO. GARESFIELD COKE.

RAMSAY'S FIRE-CLAY ARTICLES.
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FIRE-BRICK WORKS, established 1804.
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Patentees of the Standard Gasometers for the Government, and of the
IMPROVED DRY GAS-METERS.
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1862.
CLASSES X. AND XXXI.
CLASS X.—"*For ingenuity, completeness, and efficiency of apparatus used in measuring gas, and for excellence of material and workmanship.*"
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These Cannels are extensively used in the Gas-Works of Edinburgh, where the illuminating power of the gas is the highest in Britain.
The yield per ton is 12,573 cubic feet; illuminating power 33·8 standard candles; coke per ton 1046 lbs.
Ports of Shipment, in the Firth of Forth.

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The yield per ton is 10,650 cubic feet; illuminating power 24 standard candles; coke per ton 1216 lbs.
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The Proprietors will, in future, use their own forms of bills of lading, and also issue certificates of origin, signed, as the case may be, either by JAMES FERGUSON & Co., or by the NITSHILL & LESMAHAGO COAL COMPANY; and they request all consumers purchasing Lesmahago Coal to demand such a certificate for each cargo, and to observe that it corresponds with the bill of lading.
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1862.

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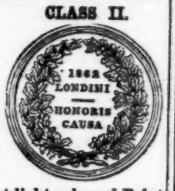

This Paint having been in general use over six years (especially in some of the principal Gas-Works), and proved itself the best light-coloured Paint produced for resisting the influence of vitiated atmospheres, it is important that its qualities should be more widely known.

It is not discoloured like white lead in a sulphuretted atmosphere, nor washed off like white zinc; and its light colour reflecting heat, produces much less expansion of gas in holders painted with it than with dark colours, besides rendering them much more sightly. Its specific gravity is so much below white lead that the same weight will cover one-third more surface, while it is equal in body; and its price being about the same (28s. per cwt.), it is actually one-third cheaper. From experience, its manufacture is greatly improved, and it is quite suitable for all purposes in which white lead is employed.

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THE BEST AND CHEAPEST

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All sizes, from ⅛ in. to 4 in. diameter and upwards.

Also,

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PACKING (Elastic) for STEAM-ENGINES.
FLANGE TUBING, for excluding Draughts and Dust through WINDOWS, DOORS, and GLASS CASES.

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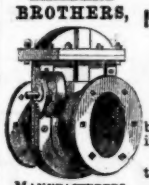

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1867.

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DRY GAS-METER MANUFACTURER,

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DRY GAS-METERS,

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ERRATUM.

In the report of the Malta and Mediterranean Gas Meeting, page 462, 2nd column, 4th line, *for* "unless *the* £15,000 *is all* subscribed for, the money will be returned," *read* "unless 1500 *shares are* subscribed for, the money will be returned."

NOTICES.

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THE JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, JULY 7, 1868.

Notes upon Passing Events.

THE price of meat is even a more important subject to Englishmen than the price of light and water; but the recent discussion on the Foreign Cattle Market Bill has shown how difficult it is to treat a commercial question on its merits. First we had the outbreak of the cattle plague, when all the political strength of the Corporation of London, of the butchers, and of the narrow-minded people who pretend to be freetraders of the Manchester school, was exerted to prevent the Government from following the advice of the Commission on the subject, and stamping out the disease. Then the plague went about devouring our live stock, until even the most bigoted cattle salesmen were frightened, if not convinced, and the whole live meat trade of the kingdom was placed under the orders of a department of the Privy Council. From anarchy our rulers flew to despotism, and, with the assistance of a colonel of engineers and a couple of veterinary professors, ukases were manufactured, issued, and enforced, by which, after a long and fatal delay, the plague was stamped out. Here we may observe how curious it is that in this eminently agricultural country, where all dignities and nearly all honours flow from the land, and where country gentlemen educated at quarter sessions preside not only over our poor-laws but over our army and navy, whenever an agricultural question arises it is handed over to the manipulation of a soldier. When protection from future attacks of cattle plague came to be considered, the most obvious remedy was a foreign cattle market, with a sort of bonded port of debarkation. For it was argued that as the cattle plague always rages in the plains of the east of Europe, and as railroads now connect the western ports with those nests of disease, the only safety for the live stock of England lay in killing all foreign cattle as they arrive if fat, and putting them in quarantine if lean. This proposal suited the British farmers very well, because it first gave their stock a certain degree of protection against infection, and next it gave British live stock some advantages in free travelling through the country. Moderate men of all parties were prepared to submit to arrangements which would be in effect a tax on foreign meat, to guard from greater evils. But there was a formidable opposition. The butchers, of course, object to every restriction. They objected to the removal of old Smithfield. They object to any interference with slaughter-houses—even to killing sheep in a cellar—and they believe in nothing that would interfere with their trade. The majority of the importers of foreign stock of course objected to a measure that seemed to restrict the operations of their live meat trade to one special market. But the opposition of these two classes would have been of little effect if they had not found a powerful political ally in the Corporation of London, the owner of a giant monopoly in the Metropolitan Cattle Market. The restrictions brought about by the cattle plague suited the owners of the Metropolitan Market perfectly well: it is their interest that cattle once sent to market should never leave it alive, but be fed in the Corporation lairs, and killed in the metropolitan slaughter-houses. The cattle plague turned the market, which had previously been a source of loss, into a source of profit. To destroy the origin of the cattle plague is to destroy a chance of income. To establish a new market at the river side is to provide either a competing market or a double expense without a doubled income. To this powerful interest was joined a section of free traders, led by Mr. Milner Gibson, who are ready to sacrifice substantial freedom of cattle commerce to a name. On the same principle they ought to oppose compulsory vaccination, and treat the Diseases Prevention Act, which has been applied to our garrison towns, as an unjustifiable attack on the liberty of prostitutes. The advocates for a separation of Foreign from the British cattle markets are unfortunate in their official leader, Lord Robert Montagu—a gentleman whose ambition considerably exceeds his abilities, and who bored the House of Commons with long-winded speeches, to which no one except himself listens with any pleasure. So the Bill was talked out, and nothing will be done this session. The meat trade will continue to exist under ukases

of the Privy Council, until a second plague falls on our flocks and herds, and gives butchers eighteen pence a pound for any meat they choose to sell. Agriculturists, like the frogs who called for a king, have lately been asking for a Minister of Agriculture. It would certainly be due to their just influence that when they go to a Government department they should be received by some one who understands them better than a colonel of engineers. But we wonder what they would gain by such a Minister of Agriculture as could be manufactured out of Lord Robert Montagu, or even the Duke of Marlborough. We should add, in fairness, that one argument of the opponents of the foreign cattle market was, that it would not be a complete protection against dissemination of disease—in fact, that it was not a perfect measure; but in reality it was not the imperfect restriction, but any restriction, to which they objected. Mr. Milner Gibson desires free trade in meat and disease. The Corporation of London desires to continue the restrictions on British cattle, which increase the trade of their lairs and slaughter-houses.

The long continuance of a sort of Spanish weather, ripening the corn and ruining the crops of mangel wurzel and other roots, has naturally called attention to the waste and want of water, and especially to the effect of systematic drainage on our springs and rivers. Now, in hundreds of villages thousands of plain country folks, who do not write to newspapers, are paying heavily in labour or in money for very indifferent water—water befouled, as surface stagnant water must be. Presently the other side of the picture will appear, and floods will sweep down our valleys, doing great mischief. It is so difficult to believe in too much rain in a dry season, and equally difficult to believe in a drought with our ordinary average rainy weather. Under these circumstances Mr. Bailey Denton, our most distinguished agricultural drainage engineer, who, it must be admitted, always has his weather eye open, has come out in the Jupiter of the press with a word in season. Mr. Denton begins by recalling that on the 17th of April he said that "an examination of the way in which the "rainfall of the last six months had been distributed would "show that a reduced summer supply was to be expected, "and how possible it would have been to have had in store a "sufficiency to meet the expected scarcity." He further observed that if the ground be not saturated in the early months of winter no amount likely to fall after Christmas "will restore the balance upon which the mean flow of our "rivers and springs depends." In January we had upwards of three inches of rain over the whole Thames basin, of which a quantity equal to a year's consumption of the metropolis, owing to the rapid way in which it fell, either covered the valley with floods or passed away to the sea. Mr. Denton gives the following table, compiled from observations made by Mr. Evans, of Hemel Hempstead:—

	Rainfall.	Percolation.	
		Chalk.	Earth.
	Inches dec.	Inches dec.	Inches dec.
October, 1867	2·02	—	—
November ,,	0·68	—	—
December ,,	1·61	0·34	—
January, 1868	3·78	3·60	1·28
February ,,	1·70	0·42	0·35
March ,,	1·57	1·00	0·40
April ,,	1·88	0·22	—
May ,,	0·85	—	—
	14·09	5·58	2·03

and observes that "although 4·31 in. of rain had fallen in "October, November, and December, none whatever pene-"trated to the gauge where 'earth' was the matter through "which it had to pass, while only one-third of an inch had "passed through the chalk in the same time. From January "to March, in which 7·05 in. of rain fell, only 2 inches seem "to have percolated through the earthy matter, while 5 "inches penetrated the chalk. We have, therefore, had to "contend against a diminished perlocation during winter, no "replenishment at all since the commencement of April up to "the present time, a vigorous vegetation during the spring, "accompanied by a rapid evaporation and a continuous "drought during the months of May and June." He therefore comes to the conclusion that "no amount of rain can "quicken the springs till November or, at the earliest, Oc-"tober. Storms and showers, such as we are now having, "may fill the ponds and ditches with water fouled by surface "refuse, and so may save the poor cottager from paying by "the pail for the water he requires; tanks and water-butts "may also be replenished, but our subterranean sources will "remain unaffected." He asks, "Ought such a state of "things to continue in a wealthy and civilized country, when "by preserving the discharged and superior waters of land "drainage, and the surplus waters of our rivers in winter, we "may secure all that is wanted for an increasing population, "and amply provide for our cattle in the fields at the same "time?" Without committing ourselves to Mr. Bailey Denton's plans, there is no doubt that his remarks deserve serious attention. The present generation will not and ought not to be satisfied with the water supply that satisfied their fathers, any more than with the imperfect system of cultivation.

The bold and ingenious attempt of the boldest of the Manchester school of railway reformers on the pockets of the travelling public having failed, and the South Thames lines being now left to conclude treaties of peace and commence without parliamentary assistance, we shall not be surprised to find a powerful party rising up amongst the shareholders in the three companies, including many directors, for the purpose of securing most of the benefits of amalgamation by simple agreements. The real difficulty lies in the contending claims for patronage of directors and for salaries of officials. Who are to be the Jonahs of the alliance? Some four or five years ago the late Mr. Frederick Slight was obliged, by the state of his health, to take his first long vacation. During his absence his chairman and the chairman of the South-Eastern drew together, and had very nearly concluded an offensive and defensive alliance, with a view to eventual amalgamation. But Mr. Slight observed, in his peculiar emphatic style, "That game would not suit me at all, so I "soon upset the job." We should recommend shareholders anxious for practical amalgamation, whether sanctioned by Parliament or not, to begin by arranging with their secretaries, traffic managers, and solicitors, settling retirements, compensations, and pensions on liberal terms, then the rest of the business will march, as the French say, "on four legs."

The Government and Mr. Bruce have both been obliged to include their education Bills amongst the slaughter of the innocents. That was to be expected; and now there are a number of self-satisfied people greatly rejoicing, and declaring that after all we are not so very badly educated a people, looking at the statistics of schools, schoolmasters, and pupils; and then they proceed to the old set of objections, in the shape of a catalogue of the difficulties in the way of making the children of very poor men go to school. Go into the poor neighbourhoods of towns, and you find crowds of children playing in the streets, who do not work. We shall not have done our duty until it is only by exception that children under ten years of age are not at school. We have placed every calling except agriculture under the educational provisions of the Factory Acts. The talk about interference with liberty is absurd. We do restrain the liberty of the subject in towns by a thousand arbitrary, but useful regulations; but we must go further—take authority to ask the pupils of the street thieves academy why they are not at a ragged or some other school! The town children of the very poor do learn to be sharp, but it is the acuteness that leads to vice and to crime. The children of the agricultural labourer are made of another sort of paste. They, even if they go to school until eight years old, grow up in helpless stolidity. They learn very little, and, for want of practice, soon forget nearly all they have learned. Mr. Bruce, who speaks with the responsibility of past and probably future official experience, observed in his speech that our statistics were swelled by including the number of children at infant schools. Infant schools play a very important part in education, although not in book education; but in Prussia, where instruction has done so much for the agricultural classes, all teaching before five years old is unnoticed, and public education is continued nine years. In this country we are stupid enough to give labourers parish relief, and not to compel their children to go to school. The people most zealous for compulsory education are the Manchester educational school, and they propose to apply it, not to the agricultural, but to their own district. Some day this must be tried. Mr. Bruce well observed—"At present education is made to depend, not on "the needs of the population, but upon the amount of voluntary "support that might be obtained in a locality;" so that there are no means of compelling an ignorant district to do its duty. Without external aid, a district of town labourers supporting a number of small shopkeepers, or a district of farmers and their labourers, may continue from year to year in hopeless ignorance, savagery, and stolid stupidity. The shopkeepers

have no interest in their customers, and too many farmers agree with the Sussex man, who said he "liked them strong "i' th' arm and weak i' th' 'ead." We may march slowly, but in our present political condition we must march surely to really national education.

The House of Commons has set a good example and commenced a war that we trust may be prosecuted against bad statues. By a very large majority it has been resolved to remove from Palace Yard Baron Marochetti's wretched abortion of Sir Robert Peel—a production even worse than the footman-like figure of Lord Clive that disgraces the native town of that great warrior and statesman. Perhaps, if we are fortunate, Mr. Bernal Osborne, or some other audacious M.P., may carry a successful assault on the ridiculous figure of the Duke of Wellington, perched like a caricature on the arch of Constitution Hill.

Unfortunately, while the House of Commons has been exhibiting an interval of common sense, the Common Council of the City of London has been preparing a piece of flunkeyism in the sham art line. A Mr. Oppenheim having—fortunate man!—made some money out of the smash of Overend and Gurney, decided very generously to sanctify his fee by expending it on some public work in the City. An excellent idea, if well carried out. The City sadly wants a public free library. The City has not at present even a decent fountain. Boys can drink from Sir James Duke's little conduit in Fleet Street, or from the confectioner-like toy structure erected before the Royal Exchange, but anything on the grandiose scale of Paris is unknown. The proper person to consult would have been the engineer or the architect of the City of London. Unfortunately, Mr. Oppenheim went to the Lord Mayor. Now mayors, ever since the Queen knighted the provost—that is, mayor—of a little town in Scotland, on the occasion of unveiling a statue of the Prince Consort, have been afflicted with a sort of Albertphobia, accompanied by a frightful thirst for knighthood. Accordingly my Lord Mayor Allen suggested another statue of Albert the Good, to be added to the City chamber of horrors, or to be set up, to be first blacked and then whitewashed, like our Queen, in the Royal Exchange. What a blessing a strong, sensible, loud-voiced, pertinacious man would be to the councils to stop the manufacture of statues. This foolish business has been undertaken at a time when the City really needs money for ornamental purposes connected with the Holborn Viaduct and the New Dead Meat Market. The architects of either have, no doubt, in their portfolios ornamental additions they would be glad to bring out if the money could be found; but then there would be no committee, no patronage of competing sculptors, no meetings for luncheons and discussion, no ceremony, procession, and possible knighting of the chairman of the committee. The moment for this prank is unfortunate.

The City has just made a substantial improvement in the traffic facilities of the Farringdon Street and Ludgate Hill traffic. A section of the Holborn Viaduct has been actually opened, thus running a close race with the Metropolitan Board of Works and its great embankments. Had the committee and officials of the viaduct done their duty, full advantage would have been taken by Messrs. Hill and Keddell of the unexampled fine weather of the last twelve months. Unfortunately the authorities for construction and the authorities for demolition have been divided. The contractors cannot get possession as rapidly as they ought, because the City architect, naturally enough, does not hurry himself to forward the glories of a rival. In the meantime the City suffers in reputation because an open and visible sign of revived activity in public works is delayed. One cannot help suspecting that the architect of the New Dead Meat Market is desirous of having the first innings in the opening ceremony. If this be so, it is a very short-sighted view of the case, for the viaduct is the complement of the market, which cannot enjoy the full tide of business, comfortably transacted, until all the roads connecting it with the west end of London are completed.

London has this last week seen one more effort to amuse its teeming thousands, in the opening of Alexandra Park at a shilling a head. Of late years the regular resorts of Cockney amusements have been so seriously invaded by the brick-maker and the builder that we have reason to be thankful for any arrangements for permanently securing open spaces for public amusements. At the present rate of appropriation Epping Forest will very soon be no more a forest than any of the brick and mortar parks that puzzle the stranger in the suburbs of Islington. Alexandra Park lies on the road much favoured by bean-feasters and many noisy tribes who ride in vans, wear paper feathers, play on divers discordant instruments, take a part in leap-frog or kiss-in-the-ring, and halt at many public-houses. It has an undulating surface of the stiff clay that breaks the heart of the gardener and of the contractor who does not fix his own prices, and commands views of very picturesque woodland scenery. The company was started with the same cant as the Crystal Palace—artistic, scientific, social—the palace of the people, &c. The Crystal Palace still fulfils the function of being one of the best places of amusement in the world for great multitudes, although art and science have fallen into the background, and the front is occupied by acrobats, Punch and Judy, and the sale of beer—the grand flower shows and monster musical entertainments being only interludes. But the Barnums who started the Alexandra Park having come to grief, practical men have taken it in hand, for who could be more practical than Messrs. Kelk and Lucas? A squat and hideous building has been erected, which will not cost an annual dividend in repairs like the Crystal Palace, and which may prove an attractive shelter for pleasure parties. A commencement towards obtaining shareholders has been made in the very prosaic amusement of racing. Unfortunately for the speculators who have so long waited for an opportunity, racing on London clay has proved a failure. In time, with the expenditure of another hundred thousand pounds, Alexandra Park will be a charming place for pic-nics, and may have a good income from races. At present, its popularity and profits are alike in embryo.

Circular to Gas Companies.

The gas disputes at Cambridge continue with unabated animosity, the Town and Gown character of the controversy becoming more apparent as they proceed. There was a strong muster of the commissioners on the 23rd ult., to consider the tenders for lighting the town with gas, which had been advertised for in consequence of the decision at the previous meeting to rescind the contract with the new company, on the ground that they had failed to light the town with gas on the 1st of June. A tender from the old company was the only one received, and a strong discussion arose on the question whether it should be opened, it being alleged that there was some irregularity in the proceedings. The friends of the new company again protested with much clamour against the resolution for rescinding their contract, but the vote for opening the tender was carried. The terms proposed were £3 per lamp from the 1st of September to the 31st of May, and 13s. 7d. from the 1st of June to the 31st of August, the charge for gas supplied being estimated at 2s. 10d. per 1000 feet during the winter, and 3s. during the summer months. The motion for accepting the contract was opposed on several amendments, but it was carried by 31 votes against 17, the university element among the commissioners being very apparent in the names of those who voted for accepting the tender. Several of the commissioners protested against the proceedings, and a memorial from 471 inhabitants of the town was presented in favour of the new company. The latter have, however, received a more severe blow from the decision against them of Vice-Chancellor Malins. The Bill filed by the old company had for its object to restrain the Consumers Company, Limited, from opening the streets to lay down their mains, for which they had obtained authority from the Improvement Commissioners, it being contended that the commissioners had no power to grant such an authority under their Act passed in 1788, before gas lighting was known or thought of. The Sheffield case, in which it was decided that parliamentary authority was not required to enable a gas company to lay their mains in the streets, was relied on by the defendants; but that case Vice-Chancellor Malins considered had been overruled by the decision of the Court of Queen's Bench, that the breaking open of the streets was an indictable nuisance. In the Cambridge case, however, he said the commissioners were expressly empowered by their local Act to light the town, and that general power, he considered, extended to all means of lighting whatever. So far, therefore, his decision would have been in favour of the new company, and the information would have been dismissed had the application for an injunction been disposed of before the 1st of June, but the rescinding of the con-

tract by the commissioners, at their meeting on the 2nd of that month, he considered, deprived the company of the power previously given to lay down their mains. The old company were allowed to amend their bill, so as to recite the rescinding of the contract, and when so amended the injunction was to be granted. The new company having refused to discontinue laying their mains while the bill was being amended, the Vice-Chancellor ordered the matter to be brought before him as soon as possible, and he said he should then grant an immediate injunction to restrain them from proceeding. Their costs, however, have been allowed them up to the 2nd of June, the day on which the contract was rescinded. Further litigation is, nevertheless, contemplated, for the new company dispute the right of the commissioners to rescind the contract with them for lighting the town, and have given notice of appeal to the Lords Justices against the Vice-Chancellor's decision. The lawyers have thus a fine prospect of more fees from this senseless squabble. In the meantime the old company have poured oil on the troubled waters by reducing the price of gas from 4s. to 3s. 9d. per 1000 feet, which reduction is to take effect from the 24th ult. It is to be hoped, for the sake of all concerned, that this concession will allay the storm.

We are compelled by the pressure of other matter to postpone the insertion of the judgment of the Vice-Chancellor until our next number. It was very elaborate, and entered minutely into the consideration of the Sheffield case, which has been much quoted and relied on; but this decision in equity, confirming the judgment of the Court of Queen's Bench in the Longton case, may be considered to overrule the former decision, and to establish as a principle of law that no gas company can be authorized to break open the streets for the purpose of laying mains and pipes without statutory powers. There appears, however, to be an unaccountable inconsistency in the judgment of Vice-Chancellor Malins, when expressing his opinion to that effect, with his declaration that the authority given by the Cambridge Improvement Commissioners to the new company to break open the streets was valid. If in the Longton case, which he referred to, it was decided by the Court of Queen's Bench that the commissioners, though authorized by Act of Parliament to open the streets for the purpose of lighting the public lamps with gas, had no authority to open them to lay pipes from the mains to private houses, we cannot conceive on what principle the Cambridge Commissioners—whose powers extend by their Act merely to open the streets for paving purposes—could be considered authorized to lay down gas-mains and pipes for lighting the streets and private houses with gas, which it is manifest could not have been contemplated when they obtained their Act in 1788.

A case involving the right of local authorities to interfere with gas companies in carrying on their business, which has some reference to the Cambridge Commissioners and the gas companies, is reported in the *American Gaslight Journal*. The Adrian Gas Company obtained from the Town Council an ordinance to light the town with gas for 10 years, in pursuance of which they have during the last 13 years laid down their pipes and lighted the town. The Town Council, conceiving that, as the term of the ordinance had expired, they had the power to put a stop to the further operations of the company if their wishes were not complied with, directed them to reduce the price of gas. That dictation the company refused to obey, and the council thereupon passed an ordinance declaring the gas company to be a nuisance, and ordering them to take up their pipes. The order not having been complied with, one of the officers of the town was directed to take up a portion of the mains, which he did. The gas company moved for an injunction to prevent the council from acting so outrageously, and the injunction was granted. Judge Johnson, in deciding the case, referred to many authorities which confirmed the rights of those who had been in possession for a number of years to be at least free from molestation until their rights were overthrown by law, and in reference to the claim of the Town Council, that they had supervision and control over the streets to prevent nuisances, he observed—"They have the right to the exercise "of a control to protect the easement and preserve the same "to the public, but have no property in them whatever, and "this control must be such a one as contributes to the object. "They have no unlimited power over the streets. They could "not obstruct travellers therein, nor have they the power to "establish regulations not promotive of the proper and free "use of the streets, nor have they the power to declare that a "nuisance which is no nuisance. The question of nuisance or "no nuisance is a question of law purely under the facts." This statement of the law in the United States applies equally to this country, and it is well that local authorities should be reminded that the powers conferred on them are intended solely for the public benefit.

The Legislature of the state of New York, not to be behind the Legislature of the mother country, has been trying its hand on the gas companies in the way of confiscation. A law to prohibit gas companies from collecting rent on their meters was passed by the state Legislature on the 18th of April; and to those companies who are limited to price, and are obliged to provide meters, this new law is equivalent to a confiscation of property to the amount of the meter-rent. Other companies it will not of course affect, for they will simply refuse to provide meters for their customers, who will be compelled to buy them. The notion of the state Legislature we presume to be that gas companies, like other traders, should measure their wares without cost, overlooking the difference that, in the cases of the draper or grocer, one yard-band or pair of scales may serve for all their customers, while each gas consumer measures the gas he burns on his own premises. Most families in London have a pair of scales whereby to check, from time to time, the accuracy of the weight of the bread and meat supplied to them; and, if such a practice prevail in New York, the state Legislature may next compel the bakers and butchers to provide these private checks on their fair dealing.

A parliamentary return, which we insert in another column, of the "expenses incurred in respect of proceedings in Par-"liament from 1857 to 1867," regarding the metropolis gas companies, may serve as a salutary warning against reckless gas agitation. The sums squandered since the districting arrangements of 1857 amount to nearly £105,000, without including the expenses incurred during the present session, which will probably exceed £15,000; so that, in round numbers, the sum of £120,000 will have been paid by the ratepayers and gas consumers of London in attempting to improve the supply of gas. Of the amount expended, as appears in the parliamentary return, the lawyers have pocketed by far the larger share of the spoil, and the scientific witnesses have also contrived to obtain some nice pickings from this wasteful expenditure, which ultimately comes out of the pockets of the public.

One of the offshoots of the gas agitation may be noticed in the springing up of what are termed by their concoctors "Gas Protection Societies," the professed objects of which are the protection of gas consumers from the alleged frauds of the gas companies in taking the registrations of the meters. An apt illustration of the advantages which gas consumers are likely to derive from these "protectors" was presented at the Marlborough Street police court last week, when an inspector of one of the societies was charged with having stolen a number of musical boxes from the premises of a person who had foolishly placed himself under the society's protection. The inspector took the opportunity afforded by entering the premises to inspect the meter, to carry off the boxes at various times. The frequency of his visits at length excited suspicion, and when apprehended he confessed to having committed the thefts. It seems extraordinary that persons who are so suspicious as to conceive that public companies, the directors of which are men of known integrity, would commit petty frauds, should have sufficient confidence in perfect strangers to admit them unwatched into their houses. The most obvious method that gas consumers can adopt to guard against fraud or inaccuracy is to examine the meters themselves at regular intervals, the attention of a few minutes only being required for understanding the measurements of the indices.

A brief advertisement in our last, and repeated in our present issue, announces the important fact that foreign coal now competes in our markets with the home produce. A respectable firm of coal-owners in Rhenish Prussia offers to supply in the Thames, freight and duty paid, a gas coal producing 10,000 cubic feet of 18-candle gas per ton at 19s., and, considering the superior quality of the coke this coal produces, it must drive Wigan cannel out of the London market, as it has already driven Newcastle gas coal out of the markets in Holland. The collieries are, we believe, situated in the basin of the Rhur, from which Cologne, Elberfeld and Dusseldorf, and the great steel-works of Krupp, at Essen, are supplied. At the present time, when the tendency of gas legislation is to

raise considerably the standard of illuminating power, it is of the greatest importance to gas companies to extend the sources of the supply of materials from which such an improved quality of gas can be produced, and the introduction of Westphalian gas coal into our market will tend to remove the apprehensions entertained from the rapidly diminishing supply of cannel in this country. This important event in our industrial annals is one of the beneficial results of the development of free trade, and it cannot fail to have the effect of checking combinations among the coal-owners, and of putting an end to the strikes among the working colliers and miners at home.

The report of the directors of the Paris Gas Company, presented at the last annual meeting of the shareholders, indicates a continued prosperous state of the affairs of that great undertaking. In the account which we were enabled to present, in October last, of the general progress of the company since its amalgamation into one concern, there was shown to have been a threefold increase in the annual consumption of gas during the last eleven years, the rate of annual increase having been on an average 260 millions of cubic feet; and that amount was augmented in 1867 to 502,743,000, the total consumption of the year having amounted to nearly 5 billions of cubic feet. The company supply a large quantity of gas for day consumption for heating purposes in manufactories and private houses, the quantity so consumed during the last year having been upwards of 660 millions of cubic feet. To encourage the use of gas in the daytime, the company supply at a cheap rate stoves peculiarly adapted to the economical consumption of gas for heating and cooking, and they endeavour also to promote the adoption of Lenoir's gas-engine, which, as a means of increasing the day consumption of gas, has not been hitherto sufficiently appreciated by the gas companies of this country. The gas-rental of the Paris Company in 1867 amounted to £1,328,093, being an increase on that of the preceding year of £118,089. This increase did not, however, arise so much from an addition to the number of consumers as from the quantity they consumed, which it is observed is to be attributed partly to the influence of the Exhibition, partly to the practice of lighting the shops more brilliantly, and also to the extended use of gas in lighting the upper rooms of private dwellings, to encourage which the company lay service-pipes to the upper stories at their own expense. The number of private consumers last year was 75,919, and of the public lamps, 35,617. The yearly manufacturing power of the several works of the company in December last was equal to 5,120,965,000 cubic feet, which does not greatly exceed the actual consumption of the year; but the consumption of 1867 was exceptionally large, owing to the influence of the Exhibition. The mains now laid in Paris extend 836 miles, 58 miles having been added during the last year. There was expended on the works, within the same period, £212,008, the total cost of which was £4,770,151; and, as the capital of the company —including £3,359,856 in shares, and £1,336,240 of money borrowed—amounts to £4,696,096, the expenditure exceeded the capital, £74,054. The total working expenses of the year amounted to £860,800, of which more than one-half—viz., £446,408—was for coal carbonized; £103,396 for coke, &c., for heating the retorts; £59,908 for labour; £8364 for the cost of purification; £22,440 for engineers and agents; and £19,462 for the mains and pipes. The municipal charges amounted to £118,039, which, together with other assessments, raised the total expenditure to £988,020. The receipts, including £1,328,093 for gas-rental, and £416,060 from the sale of residual products, amounted to £1,834,823, making the balance of profit £846,803, which exceeded the profits of the preceding year by £55,846. The rapid increase in the demand for gas having rendered it necessary to extend the power of manufacture, the directors recommended that a new loan should be raised to the amount of £1,120,000 on bonds to be issued to the present shareholders, which will be sufficient, it is estimated, to raise the productive power of the works to the extent of 6,533,645,000 cubic feet per annum, and thus enable them to supply the demand for gas at the present rate of increase until the year 1872. Appended to the report of the directors is the report of the auditors appointed at the previous annual meeting of the company, verifying the statement of accounts, and approving of the recommendations of the directors, whose able management of the affairs of the company is eulogized.

Communicated Article.

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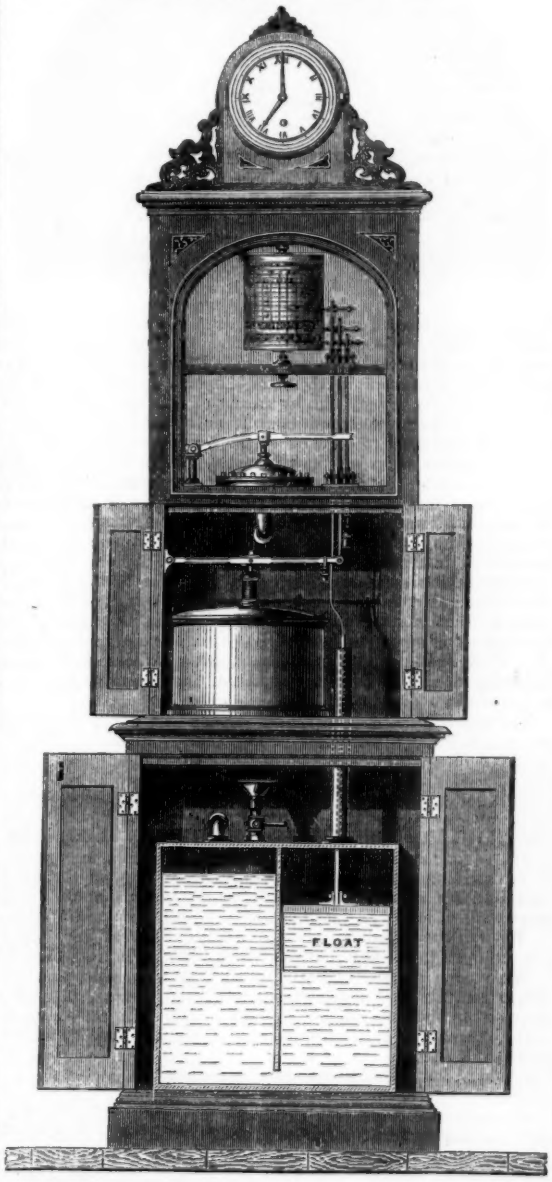
MANN'S SELF-REGISTERING APPARATUS FOR GAS-WORKS, ETC.

In a previous number of our JOURNAL (No. 404) we intimated that we were preparing for publication, by permission of Mr. W. Mann, engineer of the City of London Gas-Works, a drawing and description of an instrument in use at the above works, which on one cylinder draws a diagram of the amount of vacuum in the exhaust-pipe, the attention of the stokers to the gauge-cocks of the boilers, and also the hour and time occupied in testing the gas at the outlet-main of the purifiers. We redeem our promise in this present number, and invite our readers to a description of the very simple mechanism by which the above objects are attained.

The upper pencil or tracer records the vacuum, the rod of which is extended to a float in the cistern, shown in section, in the lower compartment of the case. The cistern is divided into two chambers, from one of which a small pipe is carried to a point where the main-pipes leading from the hydraulic mains in the retort-houses connect with the main exhaust-pipe; thus any variation in the amount of vacuum at this point affects the relative levels of water in the chambers of the cistern, and the float with its rod and pencil registers the same on the rotating cylinder shown in the upper compartment.



The middle tracer registers the time at which the gas has been tested for sulphuretted hydrogen at the main outlet-pipe of the purifiers, the length of the stroke being arranged to show the

time occupied in the test; thus, when the full stroke is registered not less time than one minute has been occupied in the test; if, on the contrary, the time occupied had been but a half minute, the tracer would only register half the full stroke. The cock on the pipe where the gas is tested is a four-way cock, the ways being so arranged that gas under pressure is contained in a small pipe connecting the same with the cylinder in the middle compartment. In the cylinder is a diaphragm, which holds the pencil up while pressure exists in the small pipe; but when the test-cock is turned to allow the gas to blow upon the test-paper, the ways of the cock release the gas under pressure from the above-named pipe, and the tracer slowly falls and registers the test on the diagram. When the test is completed, the cock is again turned, and, as before, gas under pressure enters the small pipe, and the tracer returns to its normal position until the next test is taken, which, at the above works, is done once every hour.

The lower tracer registers the attention of the stokers to the gauge-cocks of the boilers. In order to illustrate the mode of doing this, a drawing of a boiler-front is shown, with the gauge-cocks thereon; a small pipe, A, leads from the boilers to the dome-shaped chamber shown in the upper compartment of the case, the pipe

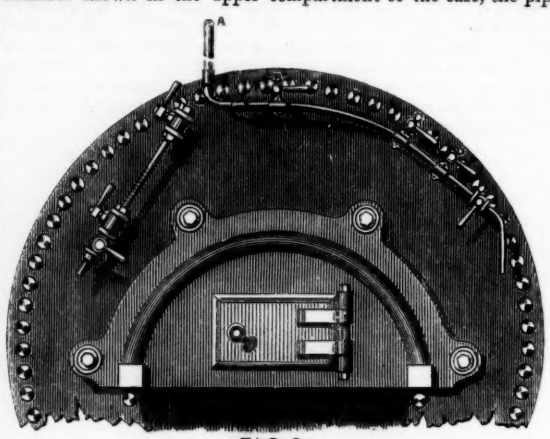


FIG. 2.

being always charged with water, except only for a short length near the boiler. We will suppose the cock B to be opened; the pressure of the steam upon the column of water forces an india-rubber disc, contained in the dome-shaped chamber, against the inner side of the dome, and by means of the lever above holds the tracer to its normal position. If now the cock B is shut, to allow the attendant to blow off at the gauge-cocks, C and D, the pressure of the steam is removed, and the tracer falls registering a vertical line on the diagram. If the gauge-cocks, C and D, be again closed and the cock B opened, the pressure of steam forces the column of water against the india-rubber disc, and the tracer returns to its position as before. At the above works the attendant is instructed to blow off every half hour, and any omission is immediately detected on reference to the diagram. We believe that Mr. Mann has arranged this part of the apparatus in such manner that a registration can be made of the blowing off of any number of boilers upon one diagram cylinder; thus it might be adapted to any manufactory where steam power is employed, and, of course, so much of the apparatus applicable to gas-works omitted therefrom.

The apparatus has been in use at the above works nearly two years, and has, we believe, never failed in its action.

Correspondence.

ON THE ESTIMATION OF SULPHUR IN COAL GAS.

SIR,—Your correspondent, M. Ellissen, of Paris, in his letter "On the Estimation of Sulphur in Coal Gas," has, on the whole, exercised his right of criticism in a very fair manner. I could have wished, however, that he had given a little more attention to the question, and he would, no doubt, have avoided laying himself open to the few remarks which I feel it my duty to make.

With your permission I will, as shortly as possible, point out where I think M. Ellissen erred, and in so doing I will adopt your correspondent's mode of dealing with the subject—from the purely theoretical or scientific point of view, as well as with its practical bearings.

I hold *that it is desirable to know the whole amount of the contamination of coal gas with sulphur compounds.*

I need scarcely assure M. Ellissen that I was led to make a series of experiments by the statements contained in the interesting and most valuable report made by him and yourself to the directors of the three City gas companies, dated June 4, 1864, and published in the form of a pamphlet, entitled "On the Sulphur Compounds present in Coal Gas." On pages 9 and 10 of this pamphlet M. Ellissen gives as the result of his experiments of passing coal gas over heated lime, "that he was able to prove in the gas the presence of a proportion of sulphur much larger than that obtained by the apparatus of Dr. Letheby. On the average, for a series of six tests, where Dr. Letheby's apparatus gave only 5·46 grains for 100 cubic feet, the lime method showed me 22·24 grains per 100 cubic feet."

This amounts, when expressed in per centage numbers, to a loss of 75·5 per cent. of the sulphur.

The experience I have had with London gas does not bear out this flagrant discrepancy between the two methods in question, as I have already had occasion to state. On the contrary, I have reason to think that well-purified gas—that is, gas purified by washing with ammoniacal liquor and by means of lime—gas in which the sulphur impurities have actually been reduced to as low a figure as 6 grains of sulphur in 100 cubic feet (on an average 12 grains)—exhibits such discrepancies in a much less marked degree. Without, of course, wishing to impugn for one moment M. Ellissen's figures, I am inclined to think that gas made from different kinds of coal, or gas differently purified, contains certain sulphur products which are comparatively more readily estimated by Dr. Letheby's method than the sulphur compounds in gas made from other coal, or in gas that has been less perfectly purified, and to attribute to this peculiar constitution of different kinds of coal gas the varying results obtained by the two methods employed by M. Ellissen. I have found that the difference between the results is less marked when gas contains less than 15 or 20 grains of sulphur, and that the lime or platinum process gives then results which are but little in excess over the results obtainable by Dr. Letheby's method.

I shall be glad if M. Ellissen (or any other of your numerous readers) will publish his experience on this interesting part of the question. I abstain from any explanation, merely stating facts.

As your correspondent has not impugned the accuracy of the method described by me on two occasions, beyond pointing out the drawbacks which I pointed out myself, and as I do not intend to avail myself of his advice to use oxygen gas instead of air for the combustion of the gas—M. Ellissen has evidently never tried the process, and his criticism lacks, therefore, the most essential recommendation, viz., that of experience—I abstain from making any remarks on this point.

I disagree with M. Ellissen "that in Dr. Letheby's process the gas is burnt under the best practical condition for a good oxidation of the sulphur contained in the gas." On looking over the above-quoted report, M. Ellissen will find that he himself has furnished the most conclusive evidence that it is not.

People do not generally sit in their drawing-rooms with some half a dozen of Leslie's burners o'erhead, which burn the gas, as much as possible, with a short blue flame, giving little or no light, into which a copious supply of ammonia gas is made to diffuse itself.

Dr. Letheby burns the gas in as artificial a manner as could possibly be imagined. M. Ellissen, on page 9 of the above-quoted report, states: "I first established that the quantity of gas burnt from the Leslie burner was of the greatest importance. The smallest quantity that can be burnt is about three-fourths of a cubic foot per hour; doubling this rate of the consumption of the gas, we obtain, with the same apparatus, *only about a quarter of the sulphur found previously.*"

Will M. Ellissen find fault with me if I infer that a *proportionate* loss of sulphur occurs between the three-fourths and one and a half cubic foot of gas? How does M. Ellissen know that no loss of sulphur occurs when the smallest quantity of gas "that can be burnt"—viz., three-fourths of a cubic foot—is consumed?

And, again, M. Ellissen says: "I next noticed that to have constant quantities of sulphur with the same gas, and flowing at the same rate from the burner, it was well to have liquid ammonia in the condensing-cylinder."

Now, surely M. Ellissen must have been aware of all this when he addressed you, stating "that the gas is consumed in the Letheby apparatus under the best practical conditions."

I maintain that the presence of gaseous ammonia in the flame of the Leslie burner (first suggested, I am informed, by the late Mr. Wright) constitutes the best feature of Dr. Letheby's sulphur test. The presence of nitrous and nitric acid in the condensed ammoniacal liquor can be readily shown. Without the simultaneous formation of such powerful oxidizing agents as nitrous and nitric acids by the combustion of the gas in ammonia vapour, I believe Dr. Letheby's test would give even less sulphur than M. Ellissen and other experimenters have found.

London gas is charged with ammonia to a sufficiently large extent to render it likely that a similar action to that observed in Dr. Letheby's test takes place when gas burns in ordinary Argand or other burners in private houses—that is to say, that a certain amount of nitrous and nitric acid is formed by the combustion. I have found that by burning gas with a Leslie burner, *without* a supply of ammonia vapour, a certain amount of nitric acid can be readily traced in the condensed liquor. I am not aware that any data exist which enable us to form an idea how much nitrous and nitric acid gets into the atmosphere by the combustion of gas from ordinary gas-burners, and I deem it of sufficient interest to go into this question as soon as time will

permit me; especially as Dr. Frankland's late admirable simplification of gas analysis has removed most of the difficulties that hitherto stood in the way of such investigations.

Having thus shown what I think "of the best practical condition for a good oxidation of the sulphur in the gas," by M. Ellissen's own published statements, I would beg of M. Ellissen to believe me when I say that I should hail with pleasure a good method for estimating the sulphur compounds in coal gas *which are actually oxidized and pass into the atmosphere of our rooms as sulphurous and sulphuric acid, under the identical conditions under which coal gas is burnt so as to produce most light.*

With a view of obtaining an approximate idea of the amount of oxidized sulphur compounds that pass into the atmosphere from an ordinary fishtail gas-burner, in contradistinction from that indicated by the Letheby test, I have made a few experiments, which you may perhaps deem of sufficient interest to give a place to. I took a good-sized retort, heated it before the gas blowpipe, and blew out a hole resembling exactly the lower opening of an ordinary gas-globe. The products of combustion passed from the retort through a glass condenser, to which a tubulated glass receiver was fixed. This receiver was joined to a two-necked Woolfe bottle, containing a solution of pure caustic soda, perfectly free from sulphuric acid. This bottle was connected with a smaller Woolfe bottle, containing a few grammes of chlorate of potash and hydrochloric acid, the latter connected with a glass tower (*éprouvette*) containing some more solution of the caustic soda. A small gas flame burning inside the retort from a clay-top fishtail burner, and consuming a little more than one cubic foot of gas per hour, served for the consumption of the gas, and a quiet current of air was made to enter the retort and to carry off the products of combustion through the various portions of the condensing apparatus. I had very little difficulty, by the proper regulation of the water aspirator, in obtaining a good steady flame consuming the gas under exactly the same conditions as a gas-jet employed for ordinary illuminating purposes. These, then, were the conditions—fair both to gas companies and to consumers, as every candid reader will admit—under which gas should be tested. What, however was the result? The following table will show:—

Date of Experiment.	Cubic Feet of Gas burnt during Experiment.	Amount of Gas burnt per Hour.	Sulphate of Barium obtained in Grammes.	Sulphur per 100 Cubic Feet in Grains.
June 15	6·	·90	·9390	33·17
	*5·9	·93	·500	17·96
16	6·	1·11	·9042	31·94
	*4·35	·87	·3341	16·28
18	5·	1·25	·7675	32·53
	*3·3	·82	·2300	14·77

On examining the retort on the following morning, I observed some oily globules of a condensed liquid all round the inside of the retort, slightly above the level at which the gas-jet had burned. I had no difficulty in recognizing these globules to be condensed oil of vitriol that had attracted moisture from the air overnight. The temperature of the glass retort was less than that required for volatilizing the sulphuric acid generated by the combustion of the gas from the little gas flame. A small amount of acid could also be traced in the glass tube of the Liebig condenser. I determined at once to collect this portion of the sulphur products of combustion separately, and to estimate by themselves the portion of the sulphur acids contained in the *clear acid* liquid that had collected in the receiver, as well as that absorbed and retained by the absorbing and oxidizing agents contained in the Woolfe bottles, and in the condensing tower. The following table—

Total Sulphur per 100 Cubic Feet of Gas in Grains.	Sulphur found in Retort and Condenser.	Sulphur from Condensed Water in Receiver.	Sulphur retained by Caustic Soda in 1st Woolfe Bot.	Sulphur retained in 2nd Wol. Bt.	Sulphur absorbed by Caustic Soda in Tower.
33·17	1·90	·79	28·47	2·00	
31·94	1·55	·90	28·15	·57	·97
32·53	1·17	1·00	26·82	1·68	1·86

will show that the principal portion was found absorbed by the alkali in the first Woolfe bottle, that a portion, however, was invariably found in the tower also; and that it is, therfore, not unreasonable to conclude that some of the sulphur—what portion it is difficult to say—escaped both oxidizing and absorbing agents contained in the second Woolfe bottle and in the glass tower; not, I believe, because of the incomplete combustion of sulphur in the gas—for sulphur burns, probably, most readily of all constituents of coal gas—but on account of the apparent impossibility of absorbing and fixing sulphurous acid gas diluted to such a great extent with other non-absorbable gases. The conclusion—it is but fair to draw—is, then, the same at which I arrived on a former occasion—viz., *that the sulphur compounds in coal gas must be burnt to sulphuric acid in order to become amenable to condensation and subsequent estimation.*

The experiment is, moreover, instructive, as it rectifies the frequently advanced notion "that the sulphur compounds produced by the combustion of gas are comparatively harmless because they pass into the air, in the combined state, as sulphate of ammonia."

* This mark indicates the analyses made simultaneously by the Letheby apparatus.

I quite agree with M. Ellissen that *this is the only reasonable view to take of the vexed sulphur question*, and I have always advocated this view. As long as we do *not* possess a reliable method for accomplishing this, I maintain, however, that it is safer "to consume or decompose the gas under conditions not in the least like the usual manner of burning gas in private houses;" under conditions, however, which, according to M. Ellissen's own showing, give us the total amount of sulphur impurities.

Another of M. Ellissen's objections—viz., that the experiments cannot be made on the average quality of the gas manufactured during the day of 24 hours—deserves, in my opinion, but little attention. I believe, from my own experience—and I am inclined to think every gas engineer will bear me out—that the gas is pretty uniformly constituted, whether manufactured early in the day or late. However, granting M. Ellissen's argument, I maintain that the consumer's interest ends when the consumption of gas ends, and that he only cares to knew how much sulphur is contained in the gas *which he burns*. I thought hitherto—I may be wrong—that it would, in fact, be desirable to estimate the sulphur in gas about the same hours when the illuminating power is determined—viz., during the hours of the principal consumption.

Regarding M. Ellissen's last objection—that my apparatus can only be used by an experienced chemist—I confess I am at a loss what to say. I am tempted to ask again, has M. Ellissen ever tried the process? If not—as I am almost forced to believe—I am, of course, suffering under the disadvantage of not being able to compare my experience with his. I am, however, surprised that he, of all men, should deny to the new process that practical working character required in a testing apparatus that is to be used rather by practical workmen than by men specially devoted to scientific pursuits. May I ask, does the process I proposed—especially in the simplified form which you were good enough to bring before your readers—entail more skilled labour than Dr. Letheby's process? No workman, I am bold to say, however intelligent, can estimate sulphur in coal gas, by whatever process he may attempt it, without having received a certain amount of special training. Surely M. Ellissen cannot be in earnest when he says that the apparatus described is adapted exclusively to the laboratory.

I leave myself, however, in the hands of your practical readers, but am thankful to M. Ellissen for admitting it to be at least a good laboratory process—a boon not to be despised, if we bear in mind the serious defects of Dr. Letheby's method, according to M. Ellissen's own showing.

Your remark, sir, "that Dr. Letheby made a large number of experiments in 1854 with an arrangement on the same principle as mine, but that the results were so unsatisfactory that the process was abandoned," is of interest only in so far as it shows that I was not the first to think of using spongy platinum for the purpose of burning coal gas. May I suggest that Dr. Letheby failed because he did not sufficiently regulate his supply of air? I have clearly stated that unless gas and air are mixed in the right proportion, sulphuretted hydrogen is invariably formed, and the sulphur is not obtained in the form of sulphuric acid, in which alone it can be condensed completely.

Now a few words with regard to the *practical* bearing of the question.

Why does the gas engineer care to know how much sulphur he has in his gas? Simply because an Act of Parliament forces him to purify it to such an extent as to leave less than 20 grains of sulphur impurities of any kind in the gas. It is the opinion of many eminent gas engineers that the gas can be purified to that extent. My own experience, gained in my capacity of examiner to one of the London gas companies, tells me that gas can be purified, and is effectually purified, even to a greater extent.

It may be pleasant to be told "that the sulphur in gas is of very little importance after all—that the product of its combustion amounts to a mere fractional part in the total products of combustion of a gas-flame—that the harm done is not worth speaking of"—and so on; not one engineer will therefore discontinue purifying his gas. Why, then, lay stress upon such matters? Independently of the scientific interest which the question of the estimation of sulphur in coal gas must possess for every practical gas engineer, it will have a more important bearing still when sulphur contamination becomes an item of gas manufacture convertible into "£ *s. d.*" As long as an Act of Parliament enjoins the purification of the gas from sulphur to a given extent, and as long as heavy penalties can be inflicted for any neglect, I maintain that it is the interest of gas engineers to obtain a fair measure, and not an uncertain one, by which the rod should be laid on. Legal quibblings whether, for instance, 100 cubic feet shall have to be burnt in order to say how much sulphur impurities are contained in the gas, because the Act of Parliament speaks of sulphur impurities in 100 cubic feet of gas, will be of little avail; and I feel sure that I express the opinion of many men well versed in gas matters when I say that it is for the interest of every gas company in London and elsewhere to possess a fair measure for those sulphur impurities which, by the best methods of purification for the time being, cannot be removed.

W. VALENTIN.

Royal College of Chemistry, June 8, 1868.

Register of New Patents.

1986.—JOHN CLARKSON MAJOR, of Wolverhampton, in the co. of Stafford, manufacturing chemist, for "*Improvements in furnaces for the production of heat by burning tar, petroleum, and other liquid combustibles, and in the mode of conducting the burning of the said combustibles.*" Patent dated July 6, 1867.

In carrying the first part of the invention into effect there is arranged in front of the furnace, at, or somewhat in advance of the place where the furnace door is ordinarily situated, a vertical opening in which a series of horizontal plates is fixed, the said plates being more or less inclined from the outside of the furnace downwards towards the inside, so that any liquid poured on the plates at the outer sides will run towards the other sides. The plates may be perforated with a series of small holes, so that liquid may flow or drop through from one plate to that next below it. In this case the openings in one plate are arranged so that they shall not be immediately over those in the plate next below it. The air for the support of combustion enters over and under the said plates, or through the openings, where there are any. In order the more effectually to retain the liquid on the plates, sand or ashes may be strewed or fixed on the plates. The tar or petroleum, &c., is supplied from a reservoir on to one or more of the plates where it is ignited. The burning combustible falls from the plate on which it is delivered to a lower plate, and the whole of the plates speedily become so heated as rapidly to volatilize, and promote the burning of the combustible. The vapour of the inflammable liquid on rising from the heated plates becomes mixed with the air passing over, or under, or through the openings in the plates, and burns with the evolution of grea heat and light. In carrying the second part of the invention into effect, a small quantity of water is added to the tar or petroleum, &c.

1992.—IVIE MACKIE M'GEORGE, of Commune Newry, Ireland, and ALFRED PAUL, of 33, Clevedon Street, Liverpool, for "*A new or improved plug-valve.*" Patent dated July 8, 1867.

The shell or body of this plug-valve resembles that of an ordinary straight or throughway stop-cock, with the exception of the opening, which is generally called the "mouth of the shell." This mouth, instead of being supplied with a gland and stuffing-box, or being entirely filled with the plug, is supplied with a lid or cover containing a stuffing-box, through which stuffing-box a spindle (called a valve-spindle) passes, having a screw upon it by which the plug or valve is opened or shut. The lid may be screwed, bolted, or otherwise fastened to the shell.

2000.—MATTHEW PIERS WATT BOULTON, of Tew Park, Oxfordshire, esquire, for "*Improvements in engines worked by the combustion of inflammable aëriform liquids, and in apparatus for producing such fluids.*" Patent dated July 8, 1867.

The invention relates to a former patent, dated March 10, 1866 (No. 738). In this apparatus the ignition of an explosive aëriform mixture is used to propel a piston, and thereby compress air or fluid in a chamber, which compressed fluid is employed to produce motive power; and the heated products of combustion are applied to a boiler for the generation of steam, which may be used in the same engine as the compressed fluid. Or the products of combustion may be employed to give out heat for other purposes.

2022.—FREDERICK HOLMES, of Plumstead, in the co. of Kent, engineer, for "*Improvements in pumps.*" Patent dated July 10, 1867.

By this invention a treble action is obtained from a single-acting pump, with two pistons on the same rod. From about the middle of a pump-barrel, having a double piston, or two pistons, the upper of which is a bucket-piston, on the same rod, a pipe is carried down which terminates at its lower end in the liquid to be raised. A pipe leads from the upper part of the barrel to deliver the liquid raised by the first pipe. From the bottom of the pump-barrel a pipe is carried down, which also terminates at its lower end in a closed chamber immersed in the liquid with which it is filled. The chamber is provided with inlet-valves, and a pipe is carried up from its lower part to deliver the liquid. It is preferred to employ two pump-barrels and two sets of pumps, the two pumps acting alternately.

2004.—JOHN JAMES BUCKLEY, of No. 1, Bond Street, in the parish of St Luke, Chelsea, and CHARLES HOOK, of Trinity Grove, Maidenstone Hill, Greenwich, in the co. of Kent, for "*The manufacture of a gas of superior illuminating and heating powers, together with the necessary appliances for the same being generated.*" Patent dated July 9, 1867.

The machinery and apparatus employed consist of a furnace constructed either of brick or iron of any shape fitted with one or more pairs of descending retorts. These retorts can be manufactured of either earthenware or iron, and be also of any shape, having air-tight clenching tops fitted to them; one of these retorts is connected by a pipe passing from a common tank or cistern of any kind, to which is attached a regulating-tap; this pipe is extended through the top of the retort to within a short distance of its base. From the top of this retort an ascending-pipe of syphon shape is attached, descending into the companion-retort to within a short distance of its base, or it may be extended in a return coil having a small receiving-retort attached to it, thus dispensing with a companion-retort. In either way, an ascending-pipe passes out from the top of the retort or furnace, and extends itself to a vessel or tank called the purifier; the said pipe passes through the top of it, and is carried down, terminating below the water which this vessel or tank is intended to contain. Another pipe, which is attached to the top of this purifier, and ascending from it, is extended to a vessel filled with water, called the cooler; within this cooler it is made to coil, and passing from it is extended to an ordinary gasometer. From the purifier a pipe, with the necessary taps attached, passes to a small vessel called the refuse-receiver containing a sieve, from which receiver a pipe passes off to the first-mentioned tank or cistern.

The process of manufacture and production is as follows:—Petroleum or any other oil capable of being turned into gas by this process is placed into the oil tank or cistern. The furnace is then lighted, and the retorts being raised to the required heat by means of ordinary fuel, the tap connecting the tank or cistern containing the petroleum or oil is turned on to a regulated point, and the petroleum or oil is allowed to flow into the heated retort. The action of the heat immediately causes it to generate; the gas thus generated travels along the ascending-pipe into the second retort or through the heated coil of piping, either of which processes is applicable for the purpose of refining. It then proceeds from the second retort through the syphon-shape pipe to the purifier, and passing through the water contained in it, and being thus divested of its impurities, it continues its course through the pipe to a vessel called the cooler or condenser, containing a coil of piping immersed in water; the gas by passing through it is cooled and condensed, and it then passes to an ordinary gasometer fit for use. From the purifier a pipe with a tap is so arranged that the refuse or impurities left on the surface of the water contained therein can be drawn off to a refuse-tank, when it passes through the sieve contained therein, and thence along a pipe to the original cistern, and, mixing itself with the fresh petroleum or oil, is reburnt, thus preventing waste. By the foregoing simple process a gas of great purity and illuminating power is obtained, fitted in every way for cooking and heating purposes. It can be conveyed without difficulty through such pipes as are commonly used for gas into ordinary houses, and furnish the consumer with a constant supply in the same manner as common coal gas.

2045.—FREDERICK WILKINS, of 20, York Buildings, Adelphi, in the co. of Middlesex, civil engineer, for "*Improvements in apparatus for producing or increasing the light or heat from carbonized atmospheric air, gas, or gaseous mixtures, by the use of hydrocarbons, oils, spirits, or other inflammable liquids, or any mixture thereof.*" Patent dated July 12, 1867.

This invention relates to certain improvements in apparatus for producing or increasing light and heat from carbonized or carburetted atmosperic air, gas, or gaseous mixtures, by the use or adaptation of hydrocarbons, oils, spirits, or any other inflammable liquids, or by any suitable admixture thereof. In supplying the liquid hydrocarbon to the burners, when it is used in conjunction with carbonized or carburetted air, or gas or gaseous mixture, as now produced by any known means, two sets of pipes are employed, one for supplying the gas or gaseous mixture, the other for conveying the liquid, both being brought to the same point, and terminating in the same burner or vessel. The gas being then lighted, the burner becomes hot, and causes the liquid to be converted into vapour, which mixes with the gas in the burner and is burned with it, the heat of the burner conducing to convert the liquid into vapour as above stated.

2124.—ARNOLD BUDENBERG, of the firm of Schaffer and Budenberg, of Manchester, in the co. of Lancaster, for "*Improvements in joints of pipes or tubes.*" A communication. Patent dated July 26, 1867.

The object of this invention is to obtain a close joint to pipes or tubes capable of being set at various angles. The parts of the pipes or tubes at the junction are of a spherical form, one part of such sphere forming part of one pipe or tube, and the other part forming part of the other pipe or tube. The parts of these spheres where the junction takes place are inclined, by preference, to an angle of 45° with the axis of the parts of the pipe, and are fitted with leather or other packing. These parts are held together by a screw-clip, or by other suitable means.

2125.—WILLIAM TAYLOR, of Nursling, in the co. of Southampton, gentleman, for "*Pipes for ventilating, heating, and vaporizing hot-houses, malthouses, and other buildings, and residences.*" Patent dated July 20, 1867.

This invention consists in the application of chambers or passages to pipes for receiving hot water, &c., so that such chamber or passage may receive water or other liquid to be evaporated, whilst they at the same time act as conduits for the passage of air for ventilation, and thereby moisten as well as heat the air so supplied for ventilation, whereby hothouses, malthouses, and other buildings, or residences, may be ventilated, heated, and vaporized.

2130.—JAMES HOOPER, of Moseley, in the co. of Worcester, plumber and glazier, for "*Improvements in ventilators.*" Patent dated July 20, 1867.

This invention consists in constructing and arranging or combining the parts of a ventilator, whereby a series of flaps or doors, covering a corresponding number of openings in the body of the ventilator may be simultaneously raised or simultaneously lowered, so as to open or close to the required degree the said openings in the ventilator, substantially as described and illustrated.

2133.—HENRY LEA, of Birmingham, in the co. of Warwick, mechanical engineer, for "*Improvements in taps or valves.*" Patent dated July 22, 1867.

The invention consists of the following arrangements, by which the flow of liquids, gases, or vapours at high pressures is controlled with great facility. As applied to the ball-cock for a water-cistern, the body of the tap is made of a circular covered vessel. The entrance-pipe is horizontal, and on one side of the vessel. The exit-pipe is situated vertically in the axis of the vessel, the top of the exit-pipe constituting the valve-seat. Across the vessel, and immediately over the valve-seat, is a division or diaphragm of leather, india-rubber, or other flexible material, which in its normal position covers the top of and closes the exit-pipe. The water presses directly against the under-side of the division or diaphragm, and is allowed to pass by a small opening to the upper side of the said division or diaphragm. The water on the upper side of the division or diaphragm presses on its whole area, while the water on the under-side of the division or diaphragm presses on a like area less the area of the valve-seat at the top of the exit-pipe; the central portion of the division or diaphragm

constituting the valve is, in consequence, held to its seat by the pressure of the water. A small valve communicates with the space above the division or diaphragm, and by opening this small valve the water may be allowed to escape from above the division or diaphragm; the pressure under the division or diaphragm being no longer counteracted by pressure above it, the said division or diaphragm rises, and water escapes down the central or exit-pipe. When the small valve described is closed, water again accumulates above the division or diaphragm, and presses it down upon the valve-seat. The stem of the small valve described rests on the lever of the floating ball, and by the rising or falling of the latter the flow of water into the cistern is regulated.

2134.—William Robert Lake, of 8, Southampton Buildings, Chancery Lane, in the co. of Middlesex, consulting engineer, for "*An improved apparatus for cleaning boiler and other tubes.*" A communication. (Complete specification.) Patent dated July 22, 1867.

This invention consists in the combination of a series of spiral scrapers with moveable and stationary heads arranged upon a guide and draught rod, in the combination of one or more elastic or flexible scrapers with the said rod, and in the combination of a coiled spring or equivalent and adjusting nut with the rod and moveable head, the whole being constructed and arranged as described.

2159.—Celi Timoleon Moulan, of Verviers, in the kingdom of Belgium, engineer, for "*Improvements in the construction of moveable joints for connecting metallic pipes and tubes.*" Provisional protection only obtained. Dated July 25, 1867.

The object of this invention is to connect together iron tubes, such as are used for gas or water. To this end a small shoulder is cast on the outside, and near the end of each of the tubes a cast-iron ring is then slipped on over the joint where the tubes are to be connected, and on either side of this ring are placed vulcanized india-rubber washers, which are firmly pressed against the ring by means of concave sockets provided with ears, whereby they are strongly bolted together by screw bolts, and, by tightly screwing up these sockets, leakage will be effectually prevented.

2173.—Edmund Smith, of the Free Town of Hamburg, Germany, gas-meter manufacturer, for "*Improvements in gas-regulators.*" Patent dated July 26, 1867.

The object of this invention is to regulate the supply of gas as it issues from the main to the burner, in order to prevent variation in the size of the flame, notwithstanding any difference that may occur in the pressure of the gas in the main. An additional illuminating power is also given to the light by means of a reflector. The invention primarily consists in placing the passage for the gas inside the regulator; a valve is placed in the base of the regulator, the upper end of which is weighted according to the quantity of gas to be consumed per hour, and connected to a diaphragm, formed by preference of leather made from goat's-skin; the space between the diaphragm and the base of the regulator forms a chamber for the reception of gas from the supply-pipe, which it enters by the valve; the pipe for conveying the gas from this chamber to the burner leading into the same, a reflector of silvered glass is placed round the tube leading to the burner; it is screwed or fixed at top to a metal cap holding the burner, which latter is made by preference of lava or steatite, and at bottom it fits into the chamber containing the diaphragm, which latter chamber is made of Britannia metal.

2179.—William Edward Newton, of 66, Chancery Lane, in the co. of Middlesex, civil engineer, for "*An improved water and gas meter.*" A communication. Patent dated July 27, 1867.

This invention relates to a new and improved water and gas meter, and consists in a novel construction and arrangement of parts whereby water or gas may be measured in the most accurate manner, and by means not liable to get out of repair or become deranged by use. The meter consists of a cylinder of any suitable dimensions and provided with a plunger. The cylinder has a chamber at one end, and within this there is a valve-chamber containing a sliding valve composed of a rod having two circular discs or heads upon it, and a circular plate at one end. This plate is perforated with holes to form a communication between the interior of the valve-chamber and the small chamber. The valve-chamber is open at both ends, and is provided with three ports which extend circumferentially around the interior of the valve-chamber. One port communicates with the supply-pipe, another with a water-passage which leads into the rear end of the cylinder, and the third communicates with the discharge-pipe. The plunger has a forked bar attached to one end of it at its centre, and to each end of this bar a rod is attached. These rods are parallel with each other, and pass loosely through flanges or bent ends of two plates connected by a pin or pivot to one end of a rod which passes loosely through the valve and has a head on its outer end. A toothed segment is suspended within the cylinder and gears into a pinion, one end of the shaft of which is provided with a crank, and the opposite end with a crank wheel, the wrist pin of which passes through an arm connected to a crank, which works an index-arm and counting apparatus. When the inlet-port is open the water will pass from the supply-pipe into the rear end of the cylinder, and will force back the plunger. After the plunger has moved back, the position of the valve is changed, and the water will be let in behind the plunger, which will thus be driven in the opposite direction. The reciprocating motions of the piston or plunger communicate motion by means of the sector-rack to the indicator.

2180.—Paul Alexandre Rohart, of Rue du Canteleux, Douai, in the département du Nord, in the empire of France, gentleman, for "*Improvements in the manufacture of gases for the production of light, heat, and motive power, and in apparatus for that purpose.*" Patent dated July 27, 1867.

To carburize or saturate a gas or the atmospheric air with the vapours of a volatile hydrocarburet so as to render it combustible, light giving, and explosive, according to the use it is intended to make of it, several indispensable conditions must be fulfilled to ensure success, to wit:—1. As far as possible the gas must be free from steam, the presence of which, when abundant relatively to the extent of saturation of the gas, impeding the assimilation of the hydrocarburetted vapours. 2. An internal source of heat must ceaselessly replace the considerable amount of latent caloric which is absorbed by the vaporization of the liquid. Without this precaution the apparatus cools, the volatility of the liquid diminishes, and the gas may be less easily saturated, which results in a great reduction in the amount of vapours carried away by the gas, and, it follows, in the intensity of the light which is produced. By properly using, on the contrary, a source of heat ceaselessly renewed, the temperature and tension of the liquid will be maintained constantly the same, as also the light-giving powers of the gas. 3. The surfaces of contact between the gases and the liquid must be multiplied as much as possible to facilitate vaporization, but without offering impediments to the flow of the gas. 4. The apparatus must be so constructed as to preclude the possibility of its being shaken, and all sudden changes which are manifested by a trepidation of the flame should be avoided. 5. The internal level of the liquid should be constantly maintained, so that the flow of the gas may take place in a regular manner, and that the carburation be always the same. 6. Finally, the burner must be disposed in a manner to effect to the best advantage the combustion of the carburetted vapours. All these dispositions are realized by the apparatus described, the combinations of which are fully set forth in the drawings accompanying the specification.

2194.—David Hodge, of Hatton Garden, and Robert Christopher Witty, of Laurel Street, Dalston, both in the co. of Middlesex, engineers, for "*Improvements in apparatus to be used in making gas from petroleum and other liquids.*" Patent dated July 29, 1867.

In carrying out this invention, a cylindrical retort of cast iron is employed, which is filled with fragments of fire-brick, &c. The retort is set in a furnace, so that it may be heated uniformly all over. Near one end of the retort is a nozzle, through which the petroleum is introduced from a cistern above; the quantity admitted is regulated by the means hereinafter described. The petroleum or liquid passing in amongst the heated fire-brick in the retort, becomes converted into permanent gas, which is led off at the other end of the retort into a washing-vessel, which is a cistern closed at the top, and having in it partitions dipping down into water. The gas entering at one end of the washing-vessel has to force itself down under these partitions, and, through the water, to get to the other end of the washing-vessel, whence it is led away, and in this manner any petroleum which escapes conversion into gas is separated and re-collected. From the washing-vessel the gas is conducted into a small gasometer, into which also the gas service-pipe opens. On the top of the gasometer a small wheel bears, the axis of which is in connexion with a lever on the plug of a stop-cock, which regulates the flow of petroleum or liquid to the retort, so that, as the gasometer fills and rises, it moves this lever, and with it the plug of the stop-cock, and so diminishes and gradually shuts off the supply of liquid.

2221.—Frederick Hale Holmes, at present residing at Paris, in the empire of France, engineer, for "*Improvements in apparatus for the production of the electric light.*" Provisional protection only obtained. Dated Aug. 1, 1867.

This invention has for its object the production of the electric light with a reduced speed of rotation, or the increasing the intensity of the light with the same speed of rotation now adopted. According to one part of this invention it is proposed to place round the axis or shaft of an electro-magnetic machine a series of armatures, varying in number from, say, sixteen to forty, such armatures being all disposed parallel with the shaft; a corresponding number of electro-magnets are fixed to a frame which surrounds the armatures above referred to. Or there may be placed round the main shaft, and parallel with it, from sixteen to forty electro-magnets, and, attached to the frame which surrounds them, a corresponding number of armatures. In either case the electric light is obtained by a velocity of revolution of the shaft ranging from 400 to 600 revolutions per minute, which is a much lower rate. Another part of the invention consists in winding on the electro-magnets and on the armatures, or on the electro-magnets only, a double or treble set of coils of either flattened or round wire, for increasing or diminishing the light by increasing or diminishing the power of the electro-magnets, since the current which produces the magnetism can by this arrangement be passed through the whole of the wire (namely, the compound coil), or through either of the simple coils.

2245.—Charles Denton Abel, of 20, Southampton Buildings, Chancery Lane, in the co. of Middlesex, patent agent, for "*Improvements in combined gas and air engines.*" A communication. Patent dated Aug. 3, 1867.

This invention has reference to a former patent (No. 434, Feb. 12, 1866), and the improvements consist, first, in an arrangement of mechanism for imparting the motion of the piston-rod to the engine-shaft, in place of the mechanism described in the specification to that patent; secondly, in certain mechanism for actuating the slide-valve, and for raising the piston before the commencement of the up stroke; thirdly, in an improved construction of the slide-valve, operating in combination with the several gas and air passages in the cylinder and valve-cover; fourth, in an improved construction of water-jacket, with provision for effecting the circulation of water therein; and, fifth, an improved mechanism for imparting the motion of the piston-rod directly to a mill-shaft by an endless band.

2246.—Richard Bewley, jun., of Uttoxeter, in the co. of Stafford, engineer, for "*Improvements in rotary pumps for raising water or other liquids.*" Provisional protection only obtained. Dated Aug. 3, 1867.

According to this invention the case within which the revolving disc or impeller works for forcing the water or other liquid admitted at its central part out through its circumference, as required, is con-

structed with an annular groove or space adapted to receive an annular ring, which is formed round the circumference of the revolving disc, the outer and inner circumferences of which ring, and the parts of the case in which the same works, are turned and bored to a truly cylindrical form. By this means a practically water-tight joint is obtained without the risk of undue friction from the contact of the working parts. The parts of the case on each side of the groove or annular space in which the disc revolves (in which parts are formed the passages for admitting the water into the disc at its central part, and those for delivering it therefrom at its circumference) are respectively furnished with radial partitions, in order to prevent loss of power in giving rotary motion to the water. The case is also constructed with one moveable side, in order to admit of the disc being taken out of the case and reinserted as required, without the necessity of disconnecting the pump from its supply and delivery pipes. This moveable side is provided with a stuffing-box, through which the shaft of the revolving disc works. The revolving disc is constructed, as above stated, with a ring adapted to fit and work in a corresponding cylindrical space formed in the case, and has the requisite water passages formed in such ring, instead of being made, as usual, to extend from the circumference to near the centre of the disc, and these water passages formed in the ring have air in volute or other suitable curvature adapted to coincide as nearly as practicable with the direction of motion of the ends of the passages. These passages through the ring of the disc are made of a uniform cross section throughout, and they are proportioned in area to the quantity of water and the height to which it is required to be raised by the pump, also to the speed at which the pump is to be worked.

2253.—George White Dinsdale, of Upper Norwood, in the co. of Surrey, plumber, for "*Improvements in the construction and manufacture of traps for water-closets, drains, and other purposes.*" Patent dated Aug. 3, 1867.

The improvements consist, first, in the construction of D or similarly shaped traps in two parts, the dip or inlet pipe being either formed as part of the shell or body, or in combination with the cover of the trap, as described; also in the construction of D or similarly shaped traps of earthenware in one or two parts, as described. Secondly, in the manufacture of D or similarly shaped traps, by casting them complete in moulds, with the dip and inlet pipe and outlet passage forming part thereof, the top or cover being cast or formed therewith, or separately therefrom, or in combination with the top or cover.

2254.—Walter Watson Hughes, of 14, Queen's Gate, Hyde Park, in the co. of Middlesex, for "*Improvements in apparatus for propelling vessels and pumping or raising water.*" Patent dated Aug. 3, 1867.

This invention relates to hydraulic pressure wheels, to be driven by steam or other power, for propelling vessels by forcing the water on which the vessels float through a tube or tubes having outlets at their sterns or sides below the surface of the water, as near to the line of the keel as may be found most convenient. Besides propelling, the apparatus is applicable for turning or stopping the vessels, as may be required, and also for pumping and raising water.

APPLICATIONS FOR LETTERS PATENT.

1988.—Matthew Piers Watt Boulton, of Tew Park, in the co. of Oxford, gentleman, for "*Improvements in apparatus for obtaining motive power by the combustion of inflammable aëriform fluids.*" June 19, 1868.

1996.—Andrew Ainslie Common, of South Bank, Regent's Park, in the co. of Middlesex, for "*Improvements in the manufacture of stench-traps for sinks and drains.*" June 20, 1868.

2006.—Robert Austin and William Kerr Austin, both of Glasgow, in the co. of Lanark, N.B., for "*Improvements in rotatory engines and pumps.*" June 22, 1868.

2029.—Benjamin Theophilus Moore, of Elm Lodge, Spring Grove, Isleworth, in the co. of Middlesex, civil engineer, for "*New or improved apparatus for protecting water-pipes from injury by frost.*" June 24, 1868.

2059.—Andrew Thomson, of the town and co. of Southampton, plumber, for "*Improvements in water-closets.*" June 26, 1868.

2065.—Paul Rapsey Hodge, of 10, Adam Street, Adelphi, in the parish of St. Martin's-in-the-Fields, in the co. of Middlesex, civil engineer, for "*Improvements in and application of the use of hydrocarbonaceous fluids in combination with highly attenuated or superheated steam for the purposes of smelting, melting, reheating, and working of metals, glass, porcelain, or calcareous materials.*" June 27, 1868.

2079.—Samuel Hannah, of Haughton-le-Skerne, near Darlington, in the co. of Durham, engineer, for "*Certain improvements in fluid-meters.*" June 29, 1868.

2084.—Alfred Vincent Newton, of 66, Chancery Lane, in the co. of Middlesex, mechanical draughtsman, for "*Improvements in liquid-meters.*" A communication. June 29, 1868.

2095.—John Henry Banks, of Brook Street, Knutsford, in the co. of Cheshire, architect and surveyor, for "*An improved method of constructing buildings, such as mission churches, chapels, schools, or any other buildings where economy of cost is an object; and for an improved heating apparatus and ventilator which may be used in the construction of the buildings, or for any other purpose.*" June 30, 1868.

2103.—William Brookes, of 62, Chancery Lane, in the co. of Middlesex, civil engineer and patent agent, for "*Improvements in meters for measuring water and other liquids.*" A communication. July 1, 1868.

GRANTS OF PROVISIONAL PROTECTION.

1408.—Francis Wise and Edward Field, both of Chandos Chambers, Adelphi, in the city of Westminster, consulting engineers, for "*Improvements in apparatus for effecting the separation or removal of foreign matters or impurities from water.*" April 30, 1868.

1444.—William Robert Lake, of 8, Southampton Buildings, Chancery Lane, in the co. of Middlesex, consulting engineer, for "*An improved mode of and apparatus for generating gas and mixing the same with atmospheric air for heating and illuminating purposes.*" A communication. May 2, 1868.

1848.—Francis Reddicliffe, late of Seglenlas Mine, Llanidloes, in the co. of Montgomery, now of Hendre Mine, in the co. of Flint, mine agent, for "*Improved mechanical arrangements applicable to pump-buckets, and partially applicable to pistons.*" June 5, 1868.

1855.—Andrew Stephen, of the Middlesex Hospital, doctor of medicine, for "*Improvements in apparatus for ventilating buildings and other structures.*" June 5, 1868.

1868.—James Young, of Kelly, in the co. of Renfrew, N.B., gentleman, for "*Improvements in treating hydrocarbons.*" June 6, 1868.

1872.—George Watson, of Bromley Street, Commercial Road, in the co. of Middlesex, engineer, Walter Joseph Baker, and Samuel Thomas Baker, both of Southwark Bridge Road, in the co. of Surrey, civil engineers, for "*An improved artesian tube well and lifting force-pump.*" June 8, 1868.

1891.—John Carter, trading as Lee and Carter, of 440, Strand, in the co. of Middlesex, bookseller, for "*An improved portable closet or commode seat.*" June 10, 1868.

1902.—William Henry Westwood, of the firm of Westwood and Wrights, of Dudley, in the co. of Worcester, manufacturers, for "*Improvements in gasholders, gas purifiers, and other apparatus used in the manufacture and distribution of gas for illumination.*" June 10, 1868.

1908.—Stanislaus Joseph Paris, David Drummond, and Daniel Hamer, all of Manchester, in the co. of Lancaster, for "*Certain improvements in valves.*" June 11, 1868.

1915.—Frederick Warner, of Jewin Crescent, in the City of London, engineer and founder, for "*Improvements in obtaining water.*" June 11, 1868.

1926.—George William Cutmore, of Holloway, in the co. of Middlesex, for "*Improvements in apparatus for cooling liquids, in connecting pipes or tubes thereto, and in joining or connecting pipes for other purposes.*" June 12, 1868.

1930.—Clement Rostaing, residing at 29, Rue le Marois, and Elie Vivet, of 43, Rue des Bourdonnais, both in Paris, in the empire of France, for "*An improved material suitable for making steam, water, and gas-tight joints, and for similar uses.*" June 12, 1868.

1954.—William Cameron Sillar, of 62, Cornhill, in the City of London, bullion broker, Robert George Sillar, of 3, Grange Road, Upper Norwood, gentleman, and George William Wigner, of Grove Lane, Camberwell, both in the co. of Surrey, chemist, for "*Improvements in deodorizing and purifying sewage and making manure therefrom.*" June 15, 1868.

1981.—William Seggie Carr, of the city and state of New York, U.S.A., for "*Improvements in water-closets.*" June 18, 1868.

NOTICES TO PROCEED.

545.—John Kirkland, of Liverpool, in the co. of Lancaster, engineer, for "*Improvements in the construction of pumps.*" Feb. 19, 1868.

578.—Lewis Matthews Becker, of 2, Guildhall Chambers, Basinghall Street, in the City of London, telegraphic engineer, for "*Improvements in the manner of indicating the position and supply of fire-plugs, fire-cocks, fire-alarms, and for other purposes.*" Feb. 21, 1868.

658.—Charles Clement Walker and William Thomas Walker, of Midland Iron-Works, Donnington, near Newport, Shropshire, engineers, for "*Improvements in centre-valves for gas-purifiers and other apparatus.*" Feb. 27, 1868.

PATENTS WHICH HAVE BECOME VOID

BY REASON OF THE NON-PAYMENT OF THE ADDITIONAL STAMP DUTY OF £50 BEFORE THE EXPIRATION OF THE THIRD YEAR.

1674.—Edward Kenworthy Dutton, "*Certain improvements in apparatus for measuring and indicating the flow of liquids.*" June 22, 1865.

1703.—Charles Worssam and George Evans, "*An improved pulping and compressing machine for the treatment of peat as a fuel and gas for illuminating purposes.*" June 26, 1865.

Parliamentary Intelligence.

HOUSE OF LORDS.

MONDAY, JUNE 22.

The Eastbourne Gas Bill was reported, with amendments.

The Dartford Water Bill was reported, without amendment.

The City of London Gas Bill was reported, with amendments, and committed to a committee of the whole House.

The Dundee Gas Bill.—As no one appeared in opposition to this Bill, it will be proceeded with as an unopposed measure.

The Sunderland and South Shields Water Bill was read a third time, and passed.

The Gaslight and Coke Company's Bill was read a third time, with the amendments, and passed, and sent to the Commons.

TUESDAY, JUNE 23.

The Dundee Gas Bill was reported, without amendment.

The Chichester Gas Bill; Merthyr Tydfil; Topsham, Woodbury, and Lympstone Water Bill; and Warrington Water Bill, were returned from the Commons, with the amendments agreed to.

THURSDAY, JUNE 25.

The Bradford Water-Works and Improvement Bill, and the Staffordshire Potteries Water Bill, were reported from the Select Committee, with amendments.

The Halifax Corporation Water-Works and Improvement Bill was reported specially from the Select Committee, with amendments.

The Windsor and Eton Water Bill.—The *locus standi* of the opponents not having been proved, this Bill will be proceeded with as an unopposed measure.

The following Bills received the Royal Assent:—CORK GAS; FARNWORTH AND KEARSLEY GAS; LEEDS NEW GAS; BRENTFORD GAS; BURSLEM AND TUNSTALL GAS; CLEVEDON GAS; CALVERLEY AND HORSFORTH DISTRICT GAS; YEADON AND GUISELEY GAS; YSTRAD GAS AND WATER; READING WATER; PETERBOROUGH GAS; SUNDERLAND AND SOUTH SHIELDS WATER; CHICHESTER GAS; MERTHYR TYDFIL GAS; TOPSHAM, WOODBURY, AND LYMPSTONE WATER; and WARRINGTON WATER.

The LLYNVI GAS Bill was reported, with amendments.

The WINDSOR AND ETON GAS Bill was reported, without amendment.

The CITY OF LONDON GAS Bill.—Amendments made, and to be reported.

A petition against the DERBY WATER Bill was deposited, from the Corporation of Derby.

FRIDAY, JUNE 26.

The MORLEY GAS Bill was returned from the Commons agreed to, with amendments. The said amendments considered and agreed to.

The WORTHING GAS Bill was returned from the Commons, with the amendments agreed to.

The DUNDEE GAS Bill was read a third time, and passed.

The EASTBOURNE GAS Bill was read a third time, with the amendments, passed, and sent to the Commons.

The CITY OF LONDON GAS Bill. The amendments were reported.

MONDAY, JUNE 29.

The DERBY WATER Bill.—The opposition was withdrawn.

The GASLIGHT AND COKE COMPANY'S Bill was returned from the Commons, with the amendments agreed to.

The RUTHIN WATER, and the WINDSOR AND ETON WATER Bills, were read a third time, and passed.

The STAFFORDSHIRE POTTERIES WATER; the HALIFAX CORPORATION WATER-WORKS AND IMPROVEMENT; the BRADFORD WATER-WORKS AND IMPROVEMENT; and the LLYNVI GAS Bills, were read a third time, with the amendments, passed, and sent to the Commons.

The CITY OF LONDON GAS Bill was read a third time, with the amendments, passed, and sent to the Commons.

TUESDAY, JUNE 30.

The DERBY WATER Bill was reported, with amendments.

THURSDAY, JULY 2.

The DARTFORD WATER Bill was read a third time, and passed.

The SLIGO BOROUGH IMPROVEMENT Bill.—The Select Committee reported that it was not expedient to proceed further with the Bill.

FRIDAY, JULY 3.

The EASTBOURNE GAS; the HALIFAX CORPORATION WATER-WORKS AND IMPROVEMENT; and the STAFFORDSHIRE POTTERIES WATER Bills, were returned from the Commons, with the amendments agreed to.

The DERBY WATER Bill was read a third time, with the amendments, passed, and sent to the Commons.

HOUSE OF COMMONS.

MONDAY, JUNE 22.

The CHICHESTER GAS; MERTHYR TYDFIL GAS; and the TOPSHAM, WOODBURY, AND LYMPSTONE WATER Bills.—The Lords amendments were agreed to.

The MORLEY GAS Bill, as amended, was considered, and to be read a third time.

TUESDAY, JUNE 23.

The WARRINGTON WATER Bill.—The Lords amendments were agreed to.

WEDNESDAY, JUNE 24.

A petition was presented against the WATER SUPPLY Bill, from Haslingden.

THURSDAY, JUNE 25.

The WORTHING GAS Bill.—The Lords amendments were agreed to.

The MORLEY GAS Bill was read the third time, and passed, with amendments.

FRIDAY, JUNE 26.

The GASLIGHT AND COKE COMPANY Bill.—The Lords amendments were agreed to.

FRIDAY, JULY 3.

The EASTBOURNE GAS; the HALIFAX CORPORATION WATER-WORKS AND IMPROVEMENT; and the STAFFORDSHIRE POTTERIES WATER Bills.—The Lords amendments were agreed to.

HOUSE OF COMMONS.

(*Before Lord* GEORGE CAVENDISH, *Chairman; Lord* PELHAM, *Mr.* TORRENS, *and Mr.* VIVIAN.)

STAFFORDSHIRE POTTERIES WATER BILL.

MONDAY, MAY 11.

Mr. LOCH, Q.C., and the Hon. GRANVILLE SOMERSET were counsel for the promoters; and Mr. HORACE LLOYD, Q.C., and Mr. SALISBURY appeared for the petitioners—the corporations of Hanley and Newcastle-under-Lyne, and the Tunstall Local Board of Health.

Mr. LOCH, in opening the case, said the bill was to extend the limits within which the company might supply water, and to empower them to construct additional works, to raise additional capital, and so on. Until the company was established in 1847, the state of the district for want of water was deplorable in the extreme. The supply was principally from surface drainage and faults in the coal measures, and it was both limited in quantity and bad in quality, and the want of it was felt to such a degree that men, women, and children would sit by the side of puddles in the streets waiting for hours for the water, in order that they might carry it to their homes. The company was formed with a share capital of £70,000, and at first their principal source of supply was at Wall Grange, a distance from Hanley of about seven miles. There they obtained their water from springs running into the river Churnet, but they were met with the opposition of the millowners, and certain concessions in respect to the construction of compensation reservoirs had to be made. It was originally calculated that the works would furnish a population of 60,000 with a supply of 20 gallons per head per day, but as the population of the Potteries had increased enormously, and houses had sprung up in all directions, it was found that, although the company had obtained a further supply of water at Meir, on the estate of the Duke of Sutherland, it was inadequate to meet the requirements of the district, and further powers were now sought for. They proposed to take more water from the springs at Wall Grange, and to enlarge their compensation reservoirs as an equivalent to the millowners; also to increase their works at Meir, and to construct additional reservoirs, by which means they would be enabled to double their present supply. The new reservoir which they proposed to construct at Upper Hulme would be capable of holding 33 millions of gallons, and in addition to this they intended to increase the capacity of the Tittesworth reservoir by raising its banks. The difficulty they expected to meet with would not be so much in regard to the quantity of water as to the mode of distributing it, as since the establishment of the company the towns had vastly increased, and now houses were erected in the highest parts of the district—much higher, in fact, than it was proposed to carry the water at the time when the works were originally constructed, so that the company had been unable to give a constant supply, and it was the object of the promoters to adopt some principle under parliamentary sanction by which they could give a supply so as to meet the increasing wants of the district. They proposed a modified system of supply, with which, no doubt, the inhabitants would be very well content, and would feel; moreover, that they were amply protected by the clauses in the bill which the promoters now asked the committee to allow. With regard to the supply, they proposed to give an intermittent instead of a constant one; and arrangements had been made with great numbers of the inhabitants, who had expressed themselves most willing to receive such a supply, and many of the petitions which were first threatened against the bill had been withdrawn in consequence. The learned counsel denied that the promoters sought by the bill to extend their limits by proposing to add the parishes of Stone and Caverswall, inasmuch as they supplied a portion of those parishes already. The Hanley petitioners stated that the company, by clauses 21, 22, and 23, sought to get rid of their responsibility as regarded giving the district a constant supply, and also that of being compelled to fix fire-plugs. It must be remembered that it was an impossibility for the company to carry water up a hill by means of gravitation, and it was impossible to give a constant supply, in the ordinary sense of the word, to places that lay on a level with their service-reservoir. They proposed, therefore, as far as the higher parts of Hanley were concerned, to give an intermittent supply of water to those parts which could not be reached by gravitation, and that the inhabitants should provide cisterns and other apparatus for storing it. They had evidence to show that this would be an ample provision to meet all the requirements that could be reasonably made. The water would still reach them in its own natural flow, though not in the quantity known as a constant supply, and a supply which the Act required. As regarded Tunstall, the case was somewhat different. There a portion of the town was actually above the source of supply, and consequently it could not be provided with water at all unless steam power was used, and this the company were quite prepared to adopt, and, in return for the expense incurred, they proposed an additional rate of 25 per cent. for that district. He would remind the committee that the promoters of the bill were men belonging to the different towns which, by their authorities, had petitioned against the bill; the interests of the whole were bound up together, and what they were now seeking to do was not in a monetary spirit at all—it was not at all as a matter of speculation, but their desire was to improve the social condition of things, and to earn a fair return for the capital they had invested in the works. The learned counsel, in conclusion, reviewed several of the most important clauses in the bill, and said that the company proposed to raise an additional capital of £26,000 by borrowing, and he respectfully asked the committee to sanction the bill which he had the honour to place before them. The following evidence was then called:—

Liddle Elliott, Esq., C.E., examined by Mr. SOMERSET.

I am the engineer of these works. I constructed them. The district is naturally a difficult one to supply with water, the whole of the country being very hilly. The population of the district which we supply is about 130,000. We were first made into a company in 1847; at that time we only provided for 60,000 persons. Previous to that period the district was in very serious distress from want of water. It was supplied from two or three sources. The town of Longton was supplied from some small works belonging to the Duke of Sutherland, and the water of which was very good; it was from the sandstone. There were two natural springs flowing down to the town. About two hours a day was the quantity that was given. It was a limited supply. There was a further supply at Hanley from some water produced in a fault in the coal measures belonging to a Mr. Smith; but that supply was very scanty and very impure. It was also costly, as they paid for cottages about 12s. per annum, though they had a very limited quantity. I imagine they did not get it more than twice a week. There was no further supply in the district of the Potteries, except those arising from small wells or drainage water, and that was very scanty, particularly in the summer time. In consequence of this the Duke of Sutherland and other gentlemen connected with the district formed a company for the supply of water. Our first Act was passed in 1847, and the Wall Grange reservoir began its supply in 1849. Our scheme was to provide 20 gallons of water per head per day for 60,000 persons. I was the engineer under the Act of 1847. The 20 gallons was of course to include trade and all purposes. In 1852, we found that this quantity was not sufficient. At that time, as now, the population was very rapidly increasing. There were many applications from small outlying districts that we did not embrace in the first instance. They were destitute of water, and we applied to Parliament to extend the works so that we might also give them a supply. In consequence of this we went for an Act, in 1853, for an extension of limits amongst other things. Clause 23 shows the limits to which our supply might be given. Amongst those limits were Normacott and Meir, and we have supplied those places from that time to the present. Normacott is in the parish of Stone. Meir is in both Caverswall and Stone. We are not going to include an additional district by our bill. We do not include an additional district beyond what we now supply. There is in the parish of Caverswall a small place called East Vale; it is close by the side of Longton. That has arisen since our Acts were obtained. We have supplied that all along, and continue to supply it; but it was not in existence when the Act was obtained in 1853, so that we now include it. There is only a permissive power to accommodate those places, the parishes of Stone and so forth. I believe it is the case that when a portion of a parish is to be supplied, Lord Redesdale insists upon the whole being put in the bill.

Mr. SOMERSET wished to know whether the opposition related to any other part of the preamble than the extension of the limits of supply.

Mr. LLOYD said that he might find it desirable to raise questions with regard to capital and works.

Mr. SOMERSET apprehended that his friend could not raise those points. There was no objection in the petition upon either capital or works.

The CHAIRMAN said the opposition appeared to be really confined to clauses, with the exception of the extension of the limits of supply.

Mr. SOMERSET stated that the promoters did not wish to extend their present actual limits of supply.

Witness: We already supply a hamlet in the parish of Caverswall. We have always served East Vale. Meir Hay is a separate township; it is that in which East Vale is situated. I am acquainted with section 35 of the Water-Works Clauses Act, 1847. It is with regard to supplying the whole of

a township if you take power to supply a part. The words are—"And the undertakers shall cause pipes to be laid down and water to be brought to every part of the town or district within the limits of the special Act, whereunto they shall be required by so many owners or occupiers in that part of the town or district as that the aggregate amount of water-rate payable by them annually, at the rate specified in the special Act, shall not be less than one-tenth part of the expense of providing and laying down such pipes; provided that no such requisition shall be binding on the undertakers unless such owners or occupiers shall severally execute an agreement binding themselves to take such supply of water for three successive years at least." The other parts of those two parishes, Stone and Caverswall, are agricultural districts where that clause could not come into effect, as there is no population to supply. We shall, therefore, only supply in that particular district a portion of those parishes which we supply now, unless a town suddenly grows up there. Stone is more than seven miles off. There is not the slightest probability of our being called upon to supply that town; we could not go there without a very large outlay, which would not pay. In 1853, we got powers to raise £35,000 and a loan of something like £7000 in addition to our former powers. The works we obtained power to build then were principally extensions in different parts scattered throughout the district. We covered two of our reservoirs, and the money was exhausted by the ordinary extensions. Unfortunately, we did not get any powers to supply an additional quantity of water. We remained at the power of 1,500,000 gallons, as far as the works of Wall Grange are concerned.

Mr. SOMERSET: I want you to explain the position of things between you and the millowners.

Witness: We had power to make an additional compensation reservoir, and when that—the Tittesworth reservoir—was made, we should be entitled, upon the certificate of the millowners engineer, to a further quantity of water; but when that reservoir was completed, the engineer and I could not agree as to the amount of the ordinary flow. First of all, he would not agree whether it was a compensation reservoir or not; but the great difficulty we had was as to what was the ordinary flow of the stream—he wanted to take it at much more than I did. In consequence of this the supply remained at 1,500,000 gallons, and this was inadequate for the supply of the district. In 1861 we came to Parliament for another Act, and the result of our application was that a compromise was effected with the millowners, whereby they took the two compensation reservoirs for 1,500,000 gallons of water that we were entitled to take before. The Tittesworth and the Deep Hayes reservoirs were considered compensation reservoirs. We got in addition, by section 37, power under certain circumstances to abstract, in addition to the 1,500,000 gallons, 2,500,000 gallons; but this power we have never been able to exercise, because we could not obtain the land for making further compensation reservoirs. The Act of 1861 enabled us to take 4,000,000 gallons altogether; but we have not been able to take that quantity for the reason which I have stated. We found the difficulties in regard to the supply of water going on, and in 1864, without the sanction of Parliament, we came to an agreement with the Duke of Sutherland at Meir, by which we were allowed to sink into the sandstone and obtain a very large amount of water; and we are still prosecuting those works. We have now obtained from them 1,250,000, and from the other works 1,500,000. We, therefore, get from Meir 1,250,000 gallons, and from Wall Grange 1,500,000 gallons, giving us altogether 2,750,000 gallons per day. The population we supply is 130,000, and generally speaking we find this supply adequate except to the high parts. Our population is increasing at the rate of 30 per cent. in 10 years; it would be double in about 30 years. We find that, in consequence of this, we want an additional supply of water. We have made a further arrangement with the Duke of Sutherland, legalizing what we did in 1864, which will give us a further supply at Meir. Before our company was formed, water-works, as I have said, were much needed. The Registrar-General reported in 1857 that "the mortality was below its average in Bristol, Clifton, Hereford, and in North Staffordshire, which has recently been supplied with good water."

The CHAIRMAN said the committee did not consider it necessary to have any further evidence of this character.

Witness: We seek under this bill a further confirmation of the agreement with the Duke of Sutherland. We expect to get 1,000,000 gallons in excess of what we are now getting, or a little over 2,250,000 gallons there. With reference to the Wall Grange district, we propose to raise the compensation reservoir, and to make a new one there, and it will give us 1,650,000 gallons; that is by arrangement with the millowners. By giving them these additional compensation reservoirs, we shall be enabled to take from our own reservoirs 1,650,000 gallons more from the springs that flow into the Churnet. We shall then have from that source 3,150,000 gallons, and adding that to the 2,250,000 gallons, will give us 5,400,000 gallons per day. Our present supply at Wall Grange is 1,500,000 gallons. The total we shall get if this bill passes, from Meir, will be 2,250,000 gallons, making a total of 5,400,000 gallons, against our present supply of 2,750,000 gallons. We conceive that our scheme is a proper one, and one which will give us a proper supply for the district, looking forward for an average number of years. The petitioners object to any extension of our limits, for fear they should not get a sufficient supply of water themselves; but we by this bill give them an additional accommodation, which we think will be ample to supply the district. In respect to capital, we ask Parliament for £105,000 share capital, and £21,000 additional borrowing powers.

Cross-examined by Mr. LLOYD: We do not supply Blurton, Trentham, or Hanford, although they are within our limits. We might be compelled to take our works to them if a requisition were got up, but that is a legal matter. We merely supply East Vale without parliamentary powers, and there are some few houses up towards Meir, in the parish of Caverswall, too. Our object is to legalize what we have done without parliamentary powers. We want also to increase our present supply. We have had complaints from Tunstall, Hanford, and Newcastle-under-Lyne of the insufficiency of our supply. We were summoned by the corporation of Newcastle. The man unfortunately had not got the water in the mains for the fire-plugs, and a policeman was set to watch us by night; and we were fined for that, not for being short of water.

Mr. LLOYD: There is always some accident. If you had known the man was watching, I dare say you would have taken care to have had water there.

Witness: I dare say we should.

Mr. LLOYD: Is it a fact that you can only supply, or have supplied, two days a week, instead of the constant supply your Act provided for?

Witness: In some places in the higher parts. We are not very short of water at Newcastle. We give a constant supply to the bulk of the town. We have had no complaints of late. We began to get the further supply of water from Meir in 1864. We did not get the water into the town till about twelve months ago. We have had no complaints within the last nine months. Our two new sources are, first, sinking and pumping at Meir. In the other case we have the right to take the water, but we want a storeage-reservoir first, after which we shall be allowed to draw more water from the springs flowing into the Churnet. We take the springs as they flow. We do not store the water for the supply, but take it straight from the springs into the pipes. We do not take the water from the river. We do not store up the water in the wet seasons for the day, except for the millowners. The quantity I have given I have no doubt will be the minimum we can get on the driest day. We cannot take the water until we make those reservoirs. There is no compulsion in our Act, and in the same way there is nothing to compel us to make the reservoir at Meir. I suppose that when the Act is passed our extension of limits would take place at once.

Re-examined by Mr. SOMERSET: We are extending the Meir works day by day. Parliament imposed very onerous clauses upon us with regard to the millowners, and difficulties arose with their engineer. It is now by agreement with them that we come here to prosecute this bill and get a further supply of water at Wall Grange. The complaint at Newcastle was the only serious one we had. I do not mean to say that we have had no complaints, of course. We supply 130,000 inhabitants with 2,750,000 gallons, making 21 gallons per head per day. We estimate upon having, with our additional supply upon the present population, 41 gallons per head per day. Of course we do not want that quantity, but that will be the effect of our scheme if carried out. In a certain number of years, I suppose, we must ask Parliament for further powers. In East Vale, which is a part of Longton, the houses have sprung up rapidly since 1849. It was not in existence at that time. It is close to our Meir works. We have supplied the other two places in the parishes of Stone and Caverswall, and with regard to the rest of the parish of Stone and the parishes of Caverswall and Trentham, and so forth, in the agricultural districts, you are only bound to supply them on their paying 10 per cent. upon the outlay. As agricultural districts, that is, of course, simply impossible.

By the COMMITTEE: We have supplied East Vale for the last fifteen years. We now come to legalize that supply by putting Caverswall in our present Act.

Mr. LOCH submitted that the only objection raised by the petitioners was the one as to the extension of the limits. Would the committee consider any further evidence to be necessary in support of the preamble?

Mr. LLOYD said that he should not object to the preamble being passed, if it was understood that he would have an opportunity of raising the question of the extension of limits on clause 4, and that he should then object to the legalizing of the supply of East Vale, if it was to be necessarily accompanied with the bringing in of the whole parish of Caverswall.

Mr. LOCH assented to the arrangement.

The CHAIRMAN stated that the committee were of opinion that the preamble of the bill was proved.

The clauses were then considered.

On clause 4 being read, Mr. *Elliott* was again examined, and, in answer to Mr. SOMERSET, said that he should have no objection to the two places, Caverswall and Stone, being struck out if Meir Hay, the township in which East Vale was situated, was retained.

Cross-examined by Mr. LLOYD: The district would not be much larger in extent if the words Meir Hay and East Vale were inserted. That would do all that is necessary for legalizing what we have done.

William Loch, Esq., examined by Mr. SOMERSET.

I am the agent for the bill. I have heard the point raised before the committee as to the insertion of the whole of a parish. The view taken by Lord Redesdale is this, as I understand—that when a parish is touched at all, they should include the whole of the parish in the bill. For instance, East Vale and Meir Hay are two names locally known, though not legally known; their limits are not defined, and in future the places as they grow up may assume different names, and so to make the thing safe Lord Redesdale has laid down a rule which I have always complied with—that when you touch a parish at all to supply it with water you must take in the whole of it. The company need not supply at once the whole parish, but no doubt they take the power of supplying the whole. I rather fear that if the names "Meir Hay" and "East Vale" were left in it would lead to a difficulty, in consequence of their limits not being legal limits.

Mr. LLOYD: I am informed that Meir Hay is legally defined for the purposes of a local board; but, apart from that, is not Meir Hay a township?

Witness: If Meir Hay is a township that would be a legal limit, no doubt. I have been told that it was without defined limits.

Mr. LLOYD: Have you ever had any case before Lord Redesdale of this kind, where it was not a question of voluntary extension into a part of a parish—taking and leaving the rest of a parish—but merely of legalizing what had been done, in which Lord Redesdale insisted that all should be included? Is not that a case that is novel to you?

Witness: It may be a case of first impression in that way.

Mr. LLOYD: What I understand Lord Redesdale says is this: You shall not pick out a part of a parish and leave the rest, particularly as the part may have no defined boundaries. But this is not a case of picking out a part of a parish, it is taking things as you find them; that is to say, taking the actual place, East Vale, and legalizing what has been done there.

Witness: Yes; but I think the principle is the same, because the difficulty is the same.

Mr. LLOYD: Surely it cannot be that a water-works company, by exceeding the powers that Parliament has given them by going over their boundary for a few yards, or a few hundred yards, can give themselves an absolute right to come and ask Parliament to extend their powers into a new parish?

Witness: They have an absolute right to come and ask Parliament. Parliament may refuse that application. It does not give the company any right, of course, to ask Parliament to give it to them.

Mr. LLOYD: There is no reason for extending it to the whole of the parish of Caverswall, as I understand, except you fear that East Vale has not a defined limit?

Witness: Precisely; and violating the rule that I understand Lord Redesdale to lay down.

Mr. LLOYD: Would you explain, then, why Stone is put in?

Witness: Stone is, I understand, the parish in which one of the places named—Normacott, I think—is partially situated.

Mr. LLOYD: There is no rule of Lord Redesdale binding you to go to the whole of a parish of which you supply part under a former Act. Normacott is under your present Act. Lord Redesdale's rule does not oblige you to put in the whole of a parish in which Normacott is situate.

Witness: According to my instructions, I was informed that it was necessary to include it, because a portion of the works of the company were situated in the parish of Stone.

Mr. LLOYD: Then Lord Redesdale would not compel you, whenever you came to Parliament to increase your limits, to take in the whole of Stone?

Witness: Not if we were not going to supply any fresh portion of Stone.

Mr. SOMERSET, in addressing the committee in support of the clause, stated that the promoters were not aware that there was a legal definition of the boundaries of the places in question, but that they would take that to be the case if Mr. Lloyd stated it to be so.

Mr. LLOYD said that it was a fact.

The CHAIRMAN said the committee were not disposed to bind down the company too closely in a rapidly increasing place like the Potteries, and that therefore, looking at the probabilities of the places already supplied growing out into the parishes of Caverswall and Stone, they would not strike the names of those parishes out of the clause.

The clause was then agreed to.

On clause 21, for altering the constant to an intermittent supply,

Mr. *Elliott* recalled, and examined by Mr. SOMERSET.

I consider this clause essential, from the circumstance that we have got several high parts of the district in which it is impossible to give a constant service—parts that have arisen since our original works were laid out. It is, in fact, impossible for us to give a constant supply to them. We propose to substitute an intermittent supply—a daily supply—sufficient for all domestic purposes. We should fill with water the cisterns or other reservoirs made by the people for the reception of water, and so give them an ample and sufficient quantity to meet the necessities of the families during the 24 hours. We should fill the cisterns every 24 hours, in fact. We should have a second lift at Tunstall, and in case of the high part we should have to pump it again; in fact, we have already a pumping station there, by which we pump it to Sandyford and Golden Hill. We do not propose to aid the supply to Hanley by steam power or by pumping. The highest parts of Hanley are about on the same level as the service-reservoir from which the water comes. When we carry out the powers we are now seeking to take, the elevations of the service-reservoirs will be sufficient to give an intermittent supply every 24 hours, but not sufficient for a constant supply. We shall supply from the service-reservoir to this high part every 24 hours. We should be able to supply the whole of Hanley without pumping, but not to give to the high part a constant service. The obligation to give a constant supply arises under the 35th section of the General Water-Works Clauses Act, the words of which are—"And such a supply shall be constantly laid on at such a pressure as will make the water reach the top story of the highest houses within the said limits, unless it be provided by the special Act that the water to be supplied by the undertakers need not be constantly laid on under pressure." When the clause speaks of pressure it means gravitation. Practically speaking, to require that the upper parts of Hanley shall be served with water to the tops of the highest houses by gravitation, is to require a physical impossibility; quite so from our reservoirs. I know the preamble of the general Act—"That this Act shall extend only to such water-works as shall be authorized by any Act of Parliament hereafter to be passed which shall declare that this Act shall be incorporated therewith" (that is, with the special Act), "and all the clauses of this Act, save so far as they shall be expressly varied or excepted by any such Act, shall apply to the undertaking authorized thereby, so far as the same shall be applicable to such undertaking." Therefore Parliament, in establishing this general rule as to the supply of houses by pressure up to top stories, contemplated at the same time that, when physical impossibilities arose, that should be modified in the special Acts. We propose, therefore, to exempt the company from the obligation of furnishing this water by gravitation to the tops of the houses of Hanley. There would be a large portion subject to this exception. It is a part that has almost altogether grown up since the passing of our original Act, and is therefore a difficulty which has been created very much by the success of our measures to supply water. The gentlemen living in the district seem to be perfectly satisfied with the arrangement proposed. This clause will touch the very highest part of Newcastle as well. Tunstall is in this position, that, besides making the supply intermittent, they were obliged to force it up to the higher parts of the town by means of steam power. The elevation of the upper part is so much above that of our service-reservoir that water can only be taken there at all by means of steam-engines; therefore, besides making it intermittent, we propose to make a charge under a separate clause upon them for that.

By the COMMITTEE: Tunstall is provided with an intermittent supply now, but not charged with an additional rate.

Cross-examined by Mr. LLOYD: Our Act was obtained in the same year as the general Act, and it has in it this clause—"That the Water-Works Clauses Act, 1847, shall be incorporated with and form part of this Act; save only that the company shall not be bound to lay on at any time the supply of water for houses to any top story not being at least 20 feet below the service-reservoir from whence the supply is taken." We have lately given a constant supply to Newcastle, since we got additional water from Meir. We cannot reach with a constant supply a place called Blampton; but it is not a very populous part. I think our clause has the word "daily" introduced (the words "when practicable," by consent, were struck out). We make it a condition that there should be cisterns and other apparatus for the reception and storeage of the water. With a daily supply the poor would not have many receptacles to purchase. We could not give a constant supply except by an enormous outlay.

By the COMMITTEE: Would it not be possible, by having storeage-reservoirs in those high places, to supply water constantly to the high parts?

Witness: No, it would be impossible; or rather the enormous expense would make it impracticable.

Mr. LOCH: How far will the rate you charge contrast with that charged in other places?

Witness: Comparing with our neighbours at Wolverhampton, we are 50 per cent. below them. The average price per house is only 9*s.* 3*d.* throughout the whole district—a little over 2*d.* a week.

By the COMMITTEE: We propose to supply Newcastle by gravitation, only we shall not be able to give it constantly.

By Mr. LOCH: The town lies on the side of a hill, and, of course, we shall not have the same chance of giving a constant supply to the upper as to the lower part. The lower part draws it off, in fact.

By the COMMITTEE: We do not propose to raise a higher rate upon those places we supply by gravitation as well as upon those we supply by steam power.

Thomas Hawksley, Esq., C.E., examined by Mr. LOCH.

I have considered clause 21, limiting the ordinary obligation of the company to supply water at a constant pressure. I think they should be partially relieved from it in respect to the more hilly parts of the district. The Water-Works Clauses Act was intended to apply to districts which are level or nearly so. Special clauses are to be inserted to meet special circumstances, so that in nearly every case now where water is supplied in hilly districts we are obliged to have a clause inserted to provide for this particular contingency, namely, that houses are built above the level to which the pipes can supply by gravitation continuously. I think these works have been laid out judiciously. It would not be a physical impossibility to carry water to the highest houses in either of the three towns; but in any sense it would be a physical impracticability, because supposing a single house became erected, or a very tall house even, in a moderately high situation, it would follow from the Act as it now stands that the company must supply continuously to the top story of that highest house. [Clause 53 of the general Act read.] I believe the limits by the bill are extended.

Mr. LOCH: I see that the Water-Works Clauses Act is incorporated subject to an exception; but still, although that be so, this section 4 does not carry the thing far enough to meet the exigencies of the present time.

Witness: The conditions under which water can be supplied from reservoirs are these. First, the water, even if there were no motion in the pipe, would only go to the level of the reservoir, but the moment the water is set in motion by reason of the draught of the inhabitants, there is a great amount of friction throughout the whole length of the pipe, which abstracts a portion of the pressure, and consequently, according as the pipe is subjected to more or less friction from the greater or less velocity of the water in it, or in accordance with its greater or less length, so the water will rise more or less closely to the level of the water in the reservoir; and usually in framing the plans for water-works, we allow for distributory pipes a friction of about 10 or 12 feet per mile, and in some cases, when the draught becomes very irregular, that extends to 20 feet in a mile. That applies even to London, so that, during the period of draught, the water will not rise within 20 feet for every mile in distance from the reservoir from which the water is drawn. It would not be possible to supply the other part of Hanley, except at an immoderate cost, with a constant supply. I see on the map a place called Norton, not far from Burslem. Now the service-reservoir at Birch's Head has an elevation of 340 feet, and part of Norton has an elevation of 342 feet, being 2 feet higher, and the other portion is 320 feet. Then there is the difference of level occasioned by friction, and then the elevation of the house itself to be supplied. Supposing a house to be only 40 feet high, and the friction to be only 20, that would give a difference due to these two causes of 60 feet. The consequence is, that at Norton there would be a deficiency of pressure varying from 40 to 60 feet, which could only be compensated for by keeping a steam-engine going day and night, and on Sundays too, in order to maintain the constancy of the supply to those houses.

By the COMMITTEE: Is there any exception in the Water-Works Clauses Act?

Witness: Yes, as follows:—"Unless it be provided by the special Act that the water to be supplied by the undertakers need not be constantly laid on under pressure." It is not so provided here except as to certain parts of the district. I have known special exceptions in quite two-thirds of all the water-works Acts which have received the sanction of the Legislature. There is a clause specially directed to this purpose. It is both impossible and unreasonable to follow out the stringent clause.

Cross-examined by Mr. LLOYD: What we are proposing to do is not merely to relax the general Act, but to alter the special Act very greatly in favour of the consumer, because under the clause the company are not bound to lay on the water at all under the circumstances to which this clause points, whereas under the new clause they must lay on the water, only they are not bound to supply it constantly.

Mr. LLOYD: But the clause is that they are not to lay on the water to the top story, but they must lay it on to the houses.

Witness: It is in the way I have stated, that the company are not bound to lay on at any time the supply of water for houses to any top story not being at least 20 feet below the service-reservoir from which the supply is taken.

Mr. LLOYD: That is to say, you must supply the house, but you need not supply the top story.

Witness: I do not suppose you need supply the house at all unless the story to be supplied is more than 20 feet below the level of it. There can be no question about that; it would be nonsense if it were not so.

Mr. LLOYD: Then you do not think, as matters stand at present, there is any obligation at all to provide a constant supply, except, in fact, where it can be done by gravitation?

Witness: I do not say so, but where it can be done by gravitation under the limitations imposed by the clause. The word "top" means any story which is within the conditions I have named. There are several places in England, on low levels, where the supply is practically constant. For the purposes of any supply higher than gravitation, to let the water flow, I should prefer pumping. It is only a question of constant or intermittent pumping, but it is one of very serious expense. In a case like this it is a question of the time you have to keep the engine in operation, and not how much per 1000 gallons, because if you have to keep the engine in operation day and night the cost will be very great, perfectly independent of the height, as it will matter very little whether it was 5 feet or 50. The extra charge proposed here is insignificant. I will suppose a case in order to make it clear. Ten houses are erected upon one of those summits; they are good houses, chargeable to the rates of the company, and they shall pay £1 a year each—that is to say, £10. You must have two men to attend to the engine all the year round, night and day, for the purpose of pumping that quantity of water, and there would be £100 to pay for the men's time out of a revenue of £10. The thing would be quite absurd. Even if there were 1000 houses to supply, what then?

Mr. *Elliott* was recalled by the committee, and said that the elevation of Hanley was nearly upon the same level as the reservoir.

Jas. Simpson, Esq., C.E., examined by Mr. SOMERSET.

I agree generally with the evidence given by the last witness. The district is peculiar, and attended with difficulty. I think that the clause, as affecting Hanley, is one which is fair and proper for the consumers. They are to have a daily and not a constant supply. It is useless talking about supplying districts at the same level with reservoirs; it cannot be done. The reservoir is not always full of water—much is lost in the transfer. The expense of pumping ought not to be put upon the company. Tunstall is much more difficult to supply than Hanley.

Cross-examined by Mr. LLOYD: I improved the works in 1853. The intention in 1847 was to give a constant supply as far as practicable. The company took the best means they could from their existing reservoir, but as the quantity of water became greater, of course the lower parts of the district commanded the higher and kept down the lower. In many instances the land is so high with reference to the houses that there is no land to construct reservoirs upon. Using the present reservoir, pumping would do all that is required at Hanley, but it would be at a very serious and uncertain expense. I have tried many times with engine power, and the engine stops and many things occur which prevent you giving a constant supply. I consider this is one of those cases which was contemplated certainly in the original Act.

Mr. LLOYD: Then why did the company agree to do, in 1853, what was apparently an impossibility?

Witness: I do not know. Parties at that time accepted Acts under almost any circumstances.

Mr. LLOYD: And took their chance of complying with them afterwards?

Witness: They did their best. I think, taking the Staffordshire Potteries altogether, it is a very extraordinary thing they have supplied them to the extent they have.

By the COMMITTEE: Are the houses on the hilly parts such as might be properly supplied with cisterns?

Witness: I think so.

By the COMMITTEE: They are such poor houses that it would be almost impossible, at a reasonable rent, to supply them with cisterns?

Witness: No; the cistern would not cost above 30s., and that would accomplish the 24 hours supply; and, in any event, they would have sufficient for water-closets.

Rev. *Fredk. Elmer*, examined by Mr. SOMERSET.

I am the incumbent of Golden Hill, which is above Tunstall. Before the company was formed there was a very bad supply of water. It was obtained mostly from surface drainage. We are supplied twice a week for the whole of the district, and more frequently for a portion of it. Altogether we are fairly supplied. The pressure is on about four hours generally. The cottagers store the water in vessels of all kinds. I have a tub under my tap and a filter. The parishioners would not object to the payment of an additional rate.

Major *Ridgway*, examined by Mr. LOCH.

I reside at Hanley. The water used to be very bad indeed. Since the company was established the supply has been satisfactory as far as my house and works are concerned. I think a daily intermittent supply would be reasonable.

Benjamin Boothroyd, Esq., examined by Mr. SOMERSET.

I am a surgeon practising at Hanley. The water is now very good. I think that a daily supply of at least two hours ought to be given to the higher parts of the town. That would be sufficient and satisfactory. The ordinary mode of storing water in the Potteries is in what is called a "gowl."

TUESDAY, MAY 12.

Mr. *Henry Meir*, examined by Mr. LOCH.

I reside at Tunstall, and am a manufacturer of earthenware. Before 1849 the condition of a greater portion of Tunstall was deplorable. There were two small wells, and I have known people wait all night for a canful of water at the spring. Since the company started they have been very fairly supplied. The company have done all they possibly could.

Cross-examined by Mr. LLOYD: A public meeting was lately held at which it was decided to oppose the bill as being likely to affect the ratepayers and inhabitants of Tunstall.

Mr. *Thomas Llewellyn*, examined by Mr. SOMERSET.

I am a solicitor at Tunstall. I do not think the company have engine power enough or room or space for it. The only fault I find with the company is, that they have been endeavouring to do too much, and to accommodate people that they could not possibly accommodate.

This was the case for the clause.

W. S. Roden, Esq., examined by Mr. SALISBURY.

I am the mayor of Hanley, and chairman of the local board. I have heard many complaints as to the water supply. I have had a very inefficient supply myself, and we never succeeded in inducing the company to improve it. They have a fair supply, but their works are badly constructed. My house is hundreds of feet below the reservoir. A supply of two hours per day would not be sufficient. Two years ago we had cholera at Hanley, supposed to have been caused by people drinking water from the wells.

James Hancock, Esq., examined by Mr. LLOYD.

I am chief bailiff of Tunstall, and chairman of the local board. I prefer a constant supply for all purposes. Without that there is not water on when a fire occurs. I think the company ought not to be relieved from the consequences of the general Act.

Mr. *Thomas Harding*, examined by Mr. SALISBURY.

I am the town-clerk of Newcastle. The company are bound to give us a constant supply. The complaints have been incessant. The company has been continually harassed by the corporation, but all in vain. If the clause were passed, the public would be entirely at the mercy of the company; they might give us a supply for five minutes only.

Mr. *Thomas Dale*, examined by Mr. LLOYD.

I am the consulting resident engineer to the Hull Water-Works. There are about 150 towns in Great Britain where a constant supply is given. The constant supply is very much more preferable to the consumer, because he gets his water cleaner and purer. [Mr. Dale spoke at some length on the importance of a constant supply for all purposes, and described the methods which the inhabitants of the Potteries and the mining districts adopted for storing the water.] He had witnessed all kinds of utensils fixed for the catching of water. Tubs and pots were fixed very often near to privies, in filth and slop yards, in sleeping-rooms, and on floors, and dogs and other animals had access to them. There is considerable saving in water in having a constant supply. In Hull it had been proved to be 25 per cent. In London the intermittent supply, on an average, is something like 32 gallons per head, whereas about 20 gallons with the constant supply is known to be sufficient. The expense of pumping is not so very serious after all. There is nothing exceptional here to make it unusually dear. The expense would be about 1s. 2d. per 1000 gallons. They ought to have duplicate engines. At Hull the charges are 6 per cent. on the actual rentals, nothing for water-closets, for baths 10s. a year, and for trade purposes the charge is from 5d. to 9d. per 1000 gallons. We have power to charge 6 per cent., but we do not do so.

Mr. LLOYD having addressed the committee in opposition to the clause, and Mr. LOCH having replied, the room was cleared, and on the parties being called in,

The CHAIRMAN said the committee had agreed to pass clause 21, subject to a provision that the daily intermittent supply should not be for less than two hours per day, and at such an hour of the day as should be most convenient to the general body of consumers, and that whenever the company should pay 7 per cent. then the supply should be constant.

The clause for granting an additional rate was then discussed, but the committee decided against it.

WEDNESDAY, MAY 13.

Clause 22—that it should not be obligatory on the company to fix fire-plugs in any main or pipe belonging to them not supplied with water by gravitation—was brought up for consideration, and evidence was called on behalf of the promoters.

Thomas Hawksley, Esq., recalled, and examined by Mr. LOCH.

I consider that as the company are relieved, by the passing of clause 21, from the obligation of constant pressure in some of their pipes, clause 22, in respect to fixing fire-plugs, would follow as a matter of course. I see no reason why the company should not continue under the obligation to fix fire-plugs, but I see every reason, and I am speaking from experience, why they should not come under the obligations of the Water Clauses Act which follow upon the fixing of fire-plugs, in the cases especially in which the water cannot be supplied by gravitation, and where consequently the water may not be constantly supplied. And the reason is that under the Water Clauses Act it becomes imperative, in the case of fire-plugs being fixed, not merely that the water shall be constantly on, but that it shall be constantly available, under certain peculiar conditions, for use in case of fire. The consequences of that have been these—that the fire insurance companies have an action against the water company in case of the slightest defect being even alleged against them with regard to the state of the fire-plugs, or with regard to the quantity or the pressure of the water supplied, and the result of that has been that in several cases most unexpectedly, where the companies were not aware when they undertook to have these fire-plugs that they were assuming any liabilities of that kind, actions have been brought against the water companies, and verdicts have passed in consequence. I believe that it was never intended that water companies should undertake such pecuniary obligations. In the case of the Leicester Water-Works, about the time it was considered twelve of the London insurance companies associated themselves together to obtain clauses to be inserted in every water-works bill for the purpose of fixing the company with these liabilities. Instead, however, of the companies being laid under these vast obligations—an obligation which, under certain circumstances, might ruin them in a single night—they were put under a penalty of £100 in default. I think the company should still be liable to put the plugs, but not be held liable for the consequences in case of a fire. As the liabilities are impossible of fulfilment except in the case of constant pressure, it is only necessary and equitable that they should be relieved.

Mr. LOCH: But, as is provided by clause 21, in case the company make a dividend of 7 per cent. at any period hereafter, the constant pressure shall then be established as a rule, then the fire-plugs and all the concurrent liabilities will recur under the clause as put before the committee.

Witness: Yes, but under somewhat modified circumstances. It is important that I should mention that, because while it is comparatively easy to keep the water constantly on under pressure in the case of gravitation, yet for special districts it is very difficult to keep it constantly on by the motion of an engine day and night without any stoppage at all. If there were a reservoir above the houses into which the water company could pump, of course the difficulty which exists in this case would be got rid of, because the moment the engine stopped for oiling or for any incidental purpose, the water would fall back from the reservoir through the pipes; but where it has to be kept up constantly by an incessant motion of an engine, there will inevitably be occasional failures. It could then be alleged against the company that the water was not on at the moment the fire took place, or was not on under the required pressure; then the company will be liable for the consequences of the fire whatever may be its extent. By clause 22 you do not go far enough for the security of the company, and perhaps you go a little too far by endeavouring to get rid of the entire obligation of putting fire-plugs to be made available as far as they can be.

The CHAIRMAN: How is the difficulty got over in London. Is there a constant pressure upon the mains by which they can be made available in the case of a fire?

Witness explained the meaning with regard to mains and service-pipes, as distinguished in London from the country, and said that in the metropolis there was no liability whatever, because the companies were not under the obligation anywhere to give a constant supply; and, therefore, the whole of the clauses which imposed those fearful liabilities upon many of the provincial companies did not apply at all to London.

By the COMMITTEE: Are not the London companies under the obligation to keep up a supply of water in case of fire?

Witness: Only to this extent, that any person may avail himself of the water in the companies pipes. There is no obligation to keep it there. It is there; and in some cases some of the companies have habitually kept the leading mains full of water. There is no waste occurring from that, because they are not connected with the houses; and, therefore, where they can do it they do it, but there is no obligation. The fire-plugs in the London districts are merely an act of grace.

The CHAIRMAN: I rather imagine that you would hold that it was expedient to have fire-plugs, because then a sudden pressure might be applied in case of a fire, and the plugs would be available.

Witness: Yes; and more than that, I think that in the case of a fire breaking out anybody should be able to resort to a fire-plug in the street, and that the fire-plug ought to be kept there for that purpose; but not that the fact of the fire-plug being there should carry all these obligations with it.

Mr. LOCH: You have no objection to the plugs, so long as there is not constant pressure and the obligations are not imposed upon the company.

The *witness* replied in the affirmative.

Cross-examined by Mr. SALISBURY; I am not called here to support the clause, but to state facts according to my own knowledge. I have not taken any part in legislation; I have not been in the House of Commons, and have no intention of going there. I have taken steps to get the public Act amended. It is only, however, to be applied by incorporation, and is to be subject to modification and variation, to suit the particular circumstances of a locality. I do not object to companies being placed under penalties. I think that has a very salutary influence upon them. They know the beginning and the end of a penalty, but not of a conflagration. I have known a case in which a company was sought to be made liable to the extent of £35,000, and all upon the plea, not that the water was not on, but that it was not on at the requisite pressure at the proper moment. If a fire were to break out in this high district of Tunstall, the people would not be able to get water from the company's mains at all; they could only draw from the pipes of the inhabitants—a common way, but not sufficient. They must get any water that there happened to be. Supposing the intermittent supply were exhausted, the town would be just in the state in which it was before the water-works were established. In most towns there are rills and wells, but I look upon those as inadequate, and therefore I say that fire-plugs ought to be established. If there is no means of getting water except by the main, and that is shut off, then they must do as in London, send to the company's engine-house and have the engine started. It is only a matter of a few minutes to generate steam in most cases. Consequences ought not to be imposed upon a company for delay. It is not a fire assurance company and receives no revenue for insuring; all is gratuitous, and therefore they ought not to be compelled to do more than they reasonably can.

The CHAIRMAN: Supposing the fire-plugs placed and the company relieved from the obligations of keeping a constant supply of water, and supposing that water was pumped up, could any provision be put in by which, on the receipt of notice, the company would be required to get their steam up immediately, and pump the water up?

Witness: Yes; a clause might be framed, and very properly so.

Mr. *Liddle Elliott* was recalled, and said that he agreed with Mr. Hawksley. In all the towns except Tunstall and Golden Hill, the company would be in a position to give water within five or ten minutes from the time of notice of any fire breaking out. In cross-examination, he said that fire-plugs had been put upon a certain portion of the company's mains. They objected to the liabilities, and not to the fire-plugs.

Mr. SALISBURY addressed the committee against the clause, contending that if the clause were allowed it would be a case of peculiar hardship upon the

public who would be entirely without protection in the case of a fire. He ridiculed the idea that steam could be got up and water supplied in ten minutes from the time when notice was given, and said that common sense told him that such could not be the case.

The room was then cleared, and after the lapse of a few minutes,

The COMMITTEE expressed their desire to ask Mr. Hawksley a few other questions.

The CHAIRMAN: Supposing a main were kept filled for the purposes of fires, would it also be liable to the drawn on by the parties who were supplied for domestic purposes?

Mr. HAWKSLEY replied in the affirmative. There would be a difficulty, he said, in keeping the mains filled for one purpose and not for another. Unless the steam-engine in this case were kept constantly in action, it would be of no use opening a fire-plug. The relief asked for in this instance was only the relief in the particular circumstances in which the water is pumped from a lower level direct into the main without a reservoir above.

After the room was again cleared,

The CHAIRMAN said that the committee had agreed to strike out clause 22, but they thought that the provisions of the general Act should be modified by a clause providing that the company should not be required to keep a constant pressure in those districts supplied under the provisions of clause 21, and that a stringent provision should be made that on notice being given of fire the water should be immediately laid on by the company.

The remaining clauses were then agreed to.

(*Before Lord* GEORGE CAVENDISH, *Chairman; Lord* PELHAM, *Sir* JOHN SIMEON, *and Mr.* TORRENS.)

WARRINGTON WATER BILL.

WEDNESDAY, MAY 13.

Mr. CLERK, Q.C., and Mr. POPE were counsel for the promoters; and Mr. STAVELEY HILL, Q.C., appeared for the sole petitioner, the Rev. F. G. Hopwood, rector of Winwick. The solicitor and agent of Lord Derby, the patron of the living, was also present, assisting in the opposition.

Mr. CLERK said that this was a bill to "amend and enlarge the provisions of the Warrington Water-Works Act, 1855; to extend the limits of the company for the supply of water; to make further and better provision for supplying Warrington and the adjoining districts with water, and for other purposes." The town of Warrington had become one of considerable importance as a manufacturing place, and was first supplied with water by means of a company established in 1846. Prior to that time the inhabitants were entirely dependent upon wells sunk in various parts of the town for water, for domestic as well as for manufacturing purposes. It was scarce and bad, and, in consequence of this condition of things, a company was formed in 1846, by Colonel Wilson Patten, Mr. Greenall, and other gentlemen, who were the largest proprietors of property there. At that time they thought of going to the very district which they now proposed to go for the purpose of obtaining water, but it was considered they might get it at a cheaper rate by going into the adjoining county of Cheshire, getting it at Appleton, and then bringing it across the Mersey. In 1855 the company were in Parliament, when their powers were extended, and they were authorized to make a reservoir at Appleton and to collect the water of certain springs to be found there. At that time the population was 23,000; at the present time it was estimated at 30,000. For some years past there had been great complaints with regard to the inadequate supply, owing to the increase of population and the growing extent of the manufactories, and amongst those who complained was the petitioner, the Rev. F. Hopwood, who resided at Winwick, but who then complained in respect of some schools at Warrington, of which he had the control. About two years ago the corporation of Warrington themselves proposed to supply the town, and to levy a rate upon the inhabitants for that purpose, and to proceed under the Health of Towns Act. Before, however, they could do this they required the consent of a majority of the ratepayers, and, when the scheme was placed before them, a strong opposition was brought forward in consequence of certain other matters of expenditure having taken place; the consent was refused, and the corporation were obliged to retire with their profit. In consequence of this it became doubly incumbent upon the existing company, the promoters of the bill, to do all that they could to meet the requirements of the town by obtaining for it a better supply of water. They consequently placed themselves in communication with experienced engineers, and the district was surveyed. In the first place they tried boring, in order to get at the underground springs if possible. In some respects they were successful, but the water was not good, and the supply was inadequate for what they required. In this state of things Mr. Duncan, of Liverpool, their engineer, proceeded to the parish of Winwick, which was known to afford an abundance of water, and of excellent quality. It was a small agricultural parish about three miles from Warrington, and there water was known to flow along the Spa Brook even in the driest seasons, and besides it was believed that, by means of wells, they would be able to get an inexhaustible supply. The inhabitants of Winwick numbered only about 450 persons, and they and the Rev. Mr. Hopwood—who was the rector, and by virtue of his living owned, excepting a very small plot, the whole of the parish, which consisted of 1431 acres—were met in the most friendly spirit. The reverend gentleman was told his neighbours at Warrington were in dire necessity for want of water, and that a better supply than they then had was urgently needed. Of course they had no right to go to their neighbours and take their water away from them to their injury, but they expressed themselves as being willing to deal with them in a fair and equitable spirit, and to give them an equivalent in the event of any damage being done. At the present time the village was supplied by means of shallow wells and from cavities in the rocks, and this water was a good deal contaminated by surface drainage. Of course, as the company would have to sink, if powers were given them, deep wells of their own, it might be possible—indeed, it was very likely—they would affect the wells from which the inhabitants now obtained their supply; and, in return for this, the company proposed to give them a sufficient supply from their own mains free of cost—a certain quantity per head on the present population, which they considered would be an ample equivalent. They were still met, however, by the opposition of the rector, whose duty it was, of course, to watch over the interests of his parishioners. All the efforts of the company to effect a compromise were useless, and in the end they were obliged to apply to Parliament for power to enable them to take that which the reverend gentleman refused to give them. The principal matter in dispute was the terms by which the company should supply the township of Winwick with water in the event of the wells being affected. The petitioner alleged the hardship that would result to Winwick by having to supply water to a town in which they had no interest whatever, and he stated that the company had not sufficiently tested their own district with regard to getting a better supply than they had already. The rector also stated that he was the owner of the land which was proposed to be taken by the company for their works, and that his interest would be affected. Of course the company would be willing to make compensation in this case, as in all others, for the land which they would require. They proposed to pay him a rent-charge instead of a lump sum, and this they were perfectly willing to do. The company wanted land, and as Mr. Hopwood was the owner of the entire parish, with the exception of a small piece of ground on which the endowed schools stood, they were compelled to take a portion of that which belonged to him; they had, in fact, no alternative, if powers were given to them. The petitioner also alleged that danger might result to the church by the company draining the quicksands of the parish, but as to that he (the learned counsel) could not speak.

Mr. STAVELEY HILL said that the petitioner would be satisfied to leave this matter to the engineer of the company.

Mr. CLERK said that, putting this question aside, the principal difference to be adjusted was that in reference to the terms on which the company should supply the parish of Winwick with water in the event of the wells being affected by their operations. He could not help saying they were willing to do all in their power to give an equivalent by supplying the farmers and villagers with an ample supply of water from their pumping-station at Winwick, and to recompense the reverend gentleman by allowing him a yearly sum in the shape of a rent-charge for the land they would require.

J. Riley, Esq., examined by Mr. CLERK.

I am the secretary and manager of the Warrington Water-Works Company. The Act under which we are now working was obtained in 1855. The supply of water to Warrington has for some years past been very insufficient, and we have had numbers of complaints respecting it. Amongst those who have complained has been the Rev. Mr. Hopwood, in regard to the supply at the schools. I believe not long ago the corporation of Warrington proposed to establish water-works for the supply of the town. They proposed to purchase our works, and entered into a treaty with us in 1865, but the ratepayers refused to sanction it.

Cross-examined by Mr. S. HILL: I am a water-drinker entirely. The water supplied by us is good. We have had borings on all Greenall's land, which run about 10,000 gallons in the 24 hours. The water in our reservoir is much softer than that. The supply has been slack, at times, since 1854. The water from the borings runs direct into the reservoir. The depth of the borings is about 165 feet. I told Mr. Hopwood that the short supply was injurious to the town, and that the company were about to take steps by which they believed it would be improved. In 1855 the company obtained further powers from Parliament, and the reservoir has never been dry since, but the complaints as to the insufficiency are still rife. In 1854, when the supply was very low, a man with a water-cart furnished the inhabitants from house to house with water at the expense of the company.

H. Bleckley, Esq., examined by Mr. CLERK.

I am the mayor of Warrington, and have been a member of the corporation for some years. I have for a long time experienced the effects of an inadequate supply of water, and in 1865 the corporation proposed to constitute a local board to supply water to the town, and they placed themselves in treaty with the present company for the purpose of purchasing their undertaking. They proposed also to get additional powers for obtaining a better supply of water; but when the matter was placed before the ratepayers they objected. It was requisite, under the Towns Improvement Act, to get their consent, and it was competent for them to raise an opposition if they thought proper, and they did so, and the scheme was not proceeded with any further. I am of opinion that a better supply of water for Warrington is absolutely necessary.

Thomas Duncan, Esq., examined by Mr. CLERK.

I am a civil engineer, and the engineer to the corporation water-works at Liverpool. I have devoted my attention for many years to the question of water supply generally, and have made it my especial study. My attention was first called to Warrington in 1865, in consequence of a communication made to me by the then engineer of the Warrington Corporation. I examined the district, and reported to the corporation as to the water supply. Subsequently, in 1867, I was called in by the present company to again examine the district and report to them as to the best mode of improving the supply which they were then obtaining, and I did so. Subsequently I came to the conclusion that the district of Winwick was best suited to the purpose. I reported to the company, and on that report this bill has been brought into Parliament. Prior to the introduction of the bill, I recommended borings in the vicinity of the existing works. In the first instance we went to the depth of 150 feet; and next we went to 165 feet. We obtained water in the first instance at a much less depth, but the quantity did not increase nor the quality improve. The water was tested analytically, and was found not to be a proper water to take to Warrington, as it was altogether unsuitable for domestic purposes. Upon its being evaporated there was a considerable deposit of sulphate of lime. There were 130 grains of solid matter in the gallon. It was a very much worse description of water than the company were delivering from their works. The Winwick water is very good, and is obtained from the red sandstone formation, and is sufficiently removed from those strata which usually contain salt. There is a spring which comes up the valley called the Spa Brook, the water in which I take to be an overflow from the red sandstone. This well has been analyzed, and I believe it is of the same character as the water which we shall be able to get by means of the well, which we propose to sink in the parish. So far as my own knowledge extends, that brook has never been known to be dry. I estimate the cost of bringing the water to Warrington—the works, mains, &c.—at £30,000. We intend to sink a well into the red sandstone, and the probability is that we shall get all the water we require by the addition of a bore-hole at the bottom, from 160 to 175 feet below the surface. The wells which the people of Winwick now use are shallow ones. I think there are twelve of them which are sunk in the sand and marl to various depths, from 12 or 14 to 17 feet. There are 35 wells in all, and those besides the twelve are deep wells sunk into the sandstone. The shallow wells will not be affected at all by the works which we propose to make, but I should not like to say that we shall not drain the others, or at least some of them. I have suggested to the company that they should give in return for the water they will take an equivalent of so much water per head per day to the entire population of the village, free of cost. I have suggested that a fountain or stand-tap should be erected by the company at Winwick village, and a supply of water be given by them in the event of any of the wells being dried or diminished in their supply. We propose to let them draw upon our supply to an extent equal to 30 gallons per head per day in the present population. They would then have a constant supply of water, perfectly free from all contamination, and delivered to them without cost from the reservoir of the company.

Cross-examined by Mr. HILL: The parish of Winwick is of considerable area, but not so the village. The water may be of value to the farmers for the purpose of cooling their produce before it is sent to the markets of Warrington and other places. I estimate that £2000 will be more than sufficient to do all the work in Winwick so as to give the villagers a supply from our mains instead of from their wells. There will be mains for the district especially. There are many scattered farms and houses in Winwick,

and it is possible that some of the distant wells may be affected. There are also dairy farms on which cattle are kept, requiring a good supply of water. There are two streams in the township, the Spa Brook and the Sankey Brook. The water of the latter, however, is so polluted by chemical works as not to be drinkable. I do not think the Spa Brook will be materially affected.

At this stage of the bill the members of the committee were summoned to a division. During their absence proposals were made by the opponents of the bill, and on the return of the committee an adjournment till next day was asked for and allowed.

THURSDAY, MAY 14.

Mr. POPE, for the promoters, stated that clauses were being drawn with a view to an arrangement, and he was requested to ask for a further adjournment to half-past one o'clock. At that hour the learned gentleman said there was a prospect of arrangement, and the chairman directed them to appear with the clauses at half-past three. At that hour both parties attended with their clauses, which were submitted to the committee and approved of. The water, it was decided, should be procured, as the promoters suggested, at Winwick, whilst they on their part should give the villagers an equivalent as proposed.

The other clauses were then gone through *pro formâ*, and the bill passed the committee.

The pumping-station is to be constructed in New Cooper's Field, near Back Lane, and a reservoir will be formed partly by excavation and partly by embankment on the north of the station, in a field called Further Rough Field. The limits of supply are prescribed by the Act to include the township of Newton-in-Mackerfield, Winwick-with-Hulme, Southworth-with-Croft, Houghton-with-Middleton and Arbury, and Poulton-with-Fearnhead, all in the county of Lancaster, and the townships of Grappenhall, and Higher and Lower Walton, in the county of Chester. The company propose to borrow additional capital to the extent of £30,000, and to issue new shares or stock, ordinary or preference, at their discretion.

METROPOLIS GAS.

EXPENSES INCURRED IN RESPECT OF PROCEEDINGS IN PARLIAMENT FROM 1857 TO 1867.

The following is a return of all charges and expenses incurred by the corporation of the City of London, the thirteen metropolitna gas companies, and by the Board of Trade, in relation to proceedings in Parliament since the districting arrangements of 1857; and also in respect of proceedings in Parliament in the years 1866 and 1867, relating to the supply of gas to the City and metropolis generally:—

CORPORATION OF LONDON AND GAS COMPANIES.

	Charges and Expenses incurred. 1857 to 1867.	1866 and 1867.
Corporation of the City of London.	£13,428 18 5	£7,199 10 5
		5,604 8 0
Chartered Gas Company	10,649 7 7	6,474 13 6
		5,636 6 1
City of London Gaslight and Coke Co.	10,614 3 10	1,700 11 2
		979 9 6*
Commercial Gas Company	2,898 17 8	713 0 0
		964 2 0
Equitable Gaslight Company	3,064 3 2	1,508 12 6†
		577 5 2‡
Great Central Gas Consumers Company	3,719 16 11	1,387 2 5
		604 10 0§
Imperial Gaslight and Coke Company	23,504 10 9	5,481 11 0
		7,971 4 2
Independent Gaslight and Coke Co.	3,291 9 4	468 7 8
		762 6 0
London Gaslight Company	5,892 3 2	2,187 6 3
		1,574 15 0
Phœnix Gaslight and Coke Company	9,741 4 4‖	1,030 9 0
		1,357 8 0‖
Ratcliff Gaslight and Coke Company	941 6 4¶	168 0 0
		341 13 4¶
South Metropolitan Gaslight Company	1,674 0 0**	1,199 0 0‡
Surrey Consumers Gas Company	2,039 14 8	440 13 4
		624 7 6
Western Gaslight Company, Limited	3,297 0 0	769 0 0
		1,557 0 0
	£94,756 16 2	£59,282 12 0

* This sum has been paid on account. The total amount cannot at present be returned, as the bill has not yet been sent in.

† This amount includes the sum of £1046 11s. 6d., relating to the company's private bill.

‡ The return for 1867 is subject to such further claim as the solicitor may have against the company.

§ This sum is paid on account only.

‖ Solicitor's bill not included.

¶ Partly estimated.

** Inclusive of £840 for company's Act, 28 Vict., c. 14.

‡ This amount does not include all the expenses by (probably) from £200 to £300, the solicitors not having sent in their final account.

BOARD OF TRADE ACCOUNTS, 1867.

To Mr. Davison, Q.C.	£518 3 6
To Mr. Reilly (including settling bill)	810 0 6
To Mr. Cox's charges (witness)	31 10 0
To Dr. Letheby's charges (witness)	44 2 0
To Professor Anderson's charges (witness)	256 19 6
To Professor Frankland's charges (witness)	116 13 0
To Mr. Hughes (engineer)	347 6 6
To publishing notice in newspapers	402 3 0
To Messrs. Wyatt and Metcalfe's costs and disbursements	1,155 2 5
	£3,682 0 5

METROPOLITAN BOARD OF WORKS.

The charges and expenses incurred by the Metropolitan Board of Works since the districting arrangements of 1857 were as follows:—

Parliamentary Agents Charges, Fees, &c.

Dyson and Co.—		
Re Metropolitan Gas Act	£42 0 0	
Re Gas Act Amendment	4 9 0	
Re Metropolis Gas Taxation	30 12 6	
Re Gas Acts	3 5 0	
Re Equitable Gas Company	0 10 6	
Re The Gaslight and Coke Company	37 5 3	
Re The Gaslight and Coke Company, and City of London Gaslight and Coke Company	35 12 5	
Re Imperial Gas Company	58 10 0	
Re London (City) Corporation Gas	96 0 10	
Re London Railways Gas	1 17 6	
Re Metropolitan Gas Act Amendment	2 2 0	
Re Wandsworth and Putney Gas	20 7 6	
Carried forward	£332 12 6	
Brought forward	£332 12 6	
Baxter, Rose, Norton and Co.—		
Minutes of evidence, *re* Phœnix Gas Bill	12 11 9	
Dorrington and Co.—		
Re Equitable Gas Bill	2 2 0	
Brydon and Robinson.—		
Re The Gaslight and Coke Company	5 5 0	
		£332 11 3
Counsels Fees.		
Gray, J., *re* Gas Acts		32 10 6
Metcalfe, W., *re* Gas Acts		4 11 6
Casson, H., *re* Gas Acts		10 6 6
Hertslet, C. J. B., *re* Gas Acts		1 1 0
Phinn, T.—		
Re Independent Gas Company	£55 13 0	
Re Phœnix Gas Company	89 5 0	
Re The Gaslight and Coke Company, and the City of London Gaslight and Coke Company	89 5 0	
		234 3 0
Cripps, H. W.—		
Re Phœnix Gas Company		78 4 6
Wilkinson, J.—		
Re The Gaslight and Coke Company, and the City of London Gaslight and Coke Company	£61 8 6	
Re Chartered Gas Company	66 13 6	
		128 2 0
Rodwell, H.—		
Re Metropolis Gas Bill	£447 6 0	
Re Imperial Gas Company	83 4 0	
Re The Gaslight and Coke Company	94 4 6	
		624 14 6
Grove, W. R.—		
Re Metropolis Gas Bill		486 8 0
Witnesses Charges, &c.		
Dangerfield, J.—		
Re Gas Acts	£65 17 8	
Cleminshaw, C. G.—		
Re Metropolitan Gas Bill	36 15 0	
Stevenson, G. W., Civil Engineer.—		
Re Metropolitan Gas Bill	168 0 0	
Hemans, G. W., Civil Engineer.—		
Re London Gaslight and Coke Company	183 15 0	
Barnett, J.—		
Re Chartered Gas Bill	42 0 0	
Hughes, S., Civil Engineer.—		
Re Gas Inquiry	100 0 0	
Frankland, E.—		
Re Metropolis Gas Bill	70 7 0	
Lucy, G.—		
Re Chartered Gas Company	4 4 0	
Miller, Professor.—		
Re Gas Bills	120 15 0	
Metchim and Son, Lithography, &c.—		
Re Gas Inquiry	7 8 7	
		799 2 3
Wyatt, R. H.—		
Taxed Costs, *re* Metropolitan Gas Inquiry	£1,620 18 10	
Extra Costs and Payments to Witnesses	350 0 0	
		1,970 18 10
Amounts Refunded to Parishes, &c., in respect of Contributions by them towards passing Gas Regulation Bill.		
St. Marylebone	£20 12 10	
St. Pancras	137 11 11	
Lambeth	158 4 8	
St. George, Hanover Square	219 9 11	
Islington	6 11 0	
Shoreditch	32 15 3	
St. Mary, Newington, Surrey	55 13 10	
Camberwell	16 7 7	
St. James, Westminster	203 2 4	
St. James and St. John, Clerkenwell	6 11 0	
Chelsea	131 0 10	
St. George-the-Martyr, Southwark	6 11 0	
St. Martin-in-the-Fields	163 16 1	
Mile-End Old Town	6 11 0	
Westminster District	131 0 10	
Greenwich District	13 2 1	
Wandsworth District	65 10 5	
St. Giles' District	72 1 6	
Holborn District	65 10 5	
Strand District	65 10 5	
Fulham District	6 11 0	
Lewisham District	26 4 2	
St. Olave's District	50 2 6	
Paddington	6 11 0	
Kensington, St. Mary Abbott's	65 10 5	
Woolwich	6 17 7	
		1,739 11 7
Total		£6,462 5 5

Legal Intelligence.

COURT OF EXCHEQUER.

WESTMINSTER, JUNE 18.

(*Before Baron* PIGOTT *and a Common Jury.*)

HOLMES *v.* KANE.

Mr. CHAMBERS, Q.C., and Mr. JOYCE were counsel for the plaintiff; Mr. KEANE, Q.C., and Mr. HOLL for the defendant.

The plaintiff in this case was an engineer, carrying on business in London. The defendant was an attorney, practising in Dublin. It appeared that two or three years ago the plaintiff was engaged in organizing a company under the name of the National Gas Company for Ireland, the object of which was to supply various towns throughout Ireland with gas. The defendant acted as his solicitor in the transactions incident to the formation of the company. Among other transactions thus arising, contracts were entered into for the purchase of land in various places. These contracts gave rise to legal proceedings in the Court of Chancery and the Landed Estates Court in Ireland, and in the course of these proceedings the plaintiff became bound to pay into court a sum of £80. According to the plaintiff's case he had given to the defendant a sum of £80, for the purpose of its being so paid in; but the defendant neglected to pay it in, in consequence of which the plaintiff was arrested under an attachment from the Court of Chancery in Ireland. According to the defendant's contention the money which had originally been given him to pay into court had been applied to other purposes under the plaintiff's own directions, and it was through the plaintiff's own fault, and by no neglect of the defendant, that the £80 was not paid in.

The jury ultimately found a verdict for the plaintiff, with £25 damages.

Miscellaneous News.

BOMBAY GAS COMPANY, LIMITED.

The Sixth Ordinary Meeting of this Company was held at the London Tavern, Bishopsgate Street, on Friday, June 26—D. T. EVANS, Esq., in the chair.

The SECRETARY (Mr. W. Marshall) having read the advertisement convening the meeting, the seal of the company was affixed to the register of shareholders, and the minutes of the last general and extraordinary meetings were read.

The following report and statements of account were then presented:—

Your directors, in meeting the shareholders for the sixth time, have pleasure in presenting a statement of accounts made up to the 31st of December last, and duly audited, with a report of the progress effected during the year.

The depression of trade and monetary embarrassments, referred to in the last report as then prevailing in Bombay, have continued throughout the year, and have operated adversely to the interests of the company. Symptoms of amendment are, however, now manifesting themselves, and there is reason to hope for a gradual return of prosperity and to a sounder state of things, by which the company must benefit materially. The progress of the company, in the face of these adverse influences, has been upon the whole not unsatisfactory, as will appear by the following comparison of the public and private lights burning respectively during the past two years.

In the report for last year the number of lights (on the 27th of April, 1867) was stated as follows:—

Private consumers	7,532 lights
Public lamps	2,168 ,,
Number of lights in course of fitting	571 ,,
	10,271 lights.

On the 28th of April last (the date of our most recent advices) there were burning—

Private consumers	10,914 lights
Public lamps	1,734 ,,
Number of lights in course of fitting	376 ,,
	13,024 lights.

From this it will be seen there is an increase in the private lights of 3382, and a decrease in public lights of 434.

The decrease in the public lights is due to the conversion of 61 ornamental tripod lamps to single lights, and the application of economy by the municipality of Bombay in the service of public lighting.

In 1866, the gas made was 35 million cubic feet, and the gas sold was 29 millions; in 1867, the gas made was 51 million cubic feet, and the gas sold was 46 millions.

The sale of cooking-stoves continues to progress, and they are reported on favourably. They are in use at the various clubs and at Government House, where they give satisfaction. A steady and increasing demand for these articles may reasonably be looked for. The Government have approved the lighting of the cathedral, and the work is in progress; 13 sun-lights of 27 lights each have been ordered for this purpose.

The number of natives taking gas is steadily, if not rapidly, increasing. The company's manager, in his report of the 28th of April, says: "The small consumers especially admit the economy of gas as compared with oil or kerosine, and during the past year many of them have permitted me to advertise their names and testimonials to that effect."

As regards the state of the works, apparatus, mains, and services, and the quality of the gas, the resident engineer reports as follows:—"The apparatus and works continue in a serviceable and good working condition. * * * The mains and services are in a sound state, as evidenced by the leakage being 10 per cent. in the past year, whilst in the preceding year it was 18 per cent. * * * The public are well satisfied with the gas. No complaints are ever made, excepting the ordinary ones common to every office, and to which prompt attention is given."

The form of the accounts, it will be observed, has been amended, and fuller particulars given, in compliance with suggestions received at last meeting.

The general revenue account shows a balance available for distribution of £4738 9s. 5d., out of this the board recommend a dividend of £2 per cent., free of income-tax, payable on the 1st prox., making, with the interim dividend of 2½ per cent., paid on the 1st of January last, a total dividend of 4½ per cent. for the year.

It will be remembered that at the last meeting a wish was expressed that some independent and reliable person should be employed to make a searching examination into the state of the works, the accounts, and the general administration of the company's affairs in Bombay. Fully recognizing the necessity for this step, your directors availed themselves of the services of Mr. Berkeley, consulting engineer to the G. I. P. Railway Company, who made a thorough investigation of all these matters on the spot, and has reported thereon to the satisfaction of the board; they also sent an inspector to examine and check the accounts, and the services of these gentlemen severally have been most advantageous to the company.

In conclusion, your directors would remind the shareholders that the operations of the company during the year (which is the second of lighting Bombay) have been carried on under unfavourable conditions. The cost of freights and prices of coal have been unusually high; the exchanges have been throughout adverse—the loss on this item alone being £817 19s. 10d., or nearly one-half per cent. of the dividend; and there has been but small profit on fittings, the charge hitherto made being considered obstructive to the introduction of gas amongst small consumers. But a favourable turn has taken place in the exchanges, the last remittance (£3000) having been made at a profit. Freights are falling, and the price of coal has fallen. Anxious to make every endeavour to support the dividend, your directors, aided by Mr. Hawksley, have materially reduced the staff and the cost of the establishment in Bombay, without, as it is believed, impairing its efficiency. All these facts tell in favour of the company; and with the steady if not rapid increase manifesting itself in the number of private consumers of gas, they look forward hopefully and confidently to the future.

Major William S. Suart and Warine B. M. Lyaley, Esq., are the directors who retire from office by rotation, and they being eligible offer themselves for re-election.

Dr. *General Balance, for the Year ended December 31, 1867.* *Cr.*

To Capital authorized—				By Construction, &c.			£155,140 10 7
(50,000 shares, at £5 each, £250,000.)				Interest paid to shareholders	£23,863 4 9		
40,000 shares, on which £5 per share have been called up and paid	£200,000 0 0			Less unclaimed	23 19 6		
10,000 shares, on which £3 per share have been called up and paid	30,000 0 0					23,839 5 3	
		£230,000 0 0		Amount owing to the company		12,249 8 2	
Amount owing by the company in London	£13,615 19 4			Goods *in transitu*		8,710 13 0	
Ditto ditto in Bombay	1,060 1 8			Stocks, viz.:—			
		14,676 1 0		Fittings	£29,080 8 9		
Dividend		5,750 0 0		Meters	8,515 18 5		
Interest		2,424 5 8		Coal	4,615 18 4		
Wear and tear account		1,000 0 0		Residual products	1,084 7 0		
Balance from general revenue account		4,738 9 5		Mains	2,600 4 8		
				Services	939 7 7		
				Lime, fire materials, tools, and sundries	2,393 11 4		
						49,229 16 1	
				Cash at bankers and in hand	£6,419 3 0		
				Bills receivable	3,000 0 0		
						9,419 3 0	
		£258,588 16 1				£258,588 16 1	

Dr. *Profit and Loss Account.* *Cr.*

To Coal carbonized, 5983 tons	£18,457 9 3		By Gas and meter rental		£29,446 12 8
Wages, maintenance of retorts, and tools	2,255 1 8		Coke		4,501 4 2
	£20,712 10 11		Tar		649 11 3
Purifying	1,152 15 10		Coal		4,488 2 1
Distribution	1,602 18 8		Fittings		601 7 1
Repairs	297 3 8		Incidental receipts		2,478 15 1
Yard and sundries	242 18 8				
Engineers salaries in India	£1,750 0 0				
Salaries in India and London	1,669 14 2				
	3,419 14 2				
Rents, rates, and taxes in India and London	1,344 14 0				
Licence-tax	200 0 0				
Loss on exchange	817 19 10				
Interest	373 1 5				
Directors and auditors remuneration	852 10 0				
Commission to collectors and canvassers in India	262 7 10				
General charges in India and London, including stationery, printing, postages, telegrams, law and incidental expenses	1,412 4 3				
Bad debts	195 2 6				
Wear and tear account	1,000 0 0				
Net profit for the year ended December 31, 1867	8,268 10 7				
	£42,165 12 4				£42,165 12 4

Dr. *General Revenue Account.* *Cr.*

To Interim dividend of 2½ per cent. declared at the extraordinary general meeting of shareholders on the 16th of December, 1867	£5,750 0 0		By Balance unappropriated at December 31, 1866	£2,219 18 10
Balance available for dividend	4,738 9 5		Net profit for the year ended December 31, 1867	8,268 10 7
	£10,488 9 5			£10,488 9 5

The CHAIRMAN: Gentlemen, I propose upon this occasion, as upon previous occasions when I have had the honour to address you, to supplement the accounts with some statements of my own. The report speaks for itself; but I propose to go through the accounts *seriatim*, taking up such points as I think may require explanation and may be interesting to you. Afterwards I shall touch upon the present circumstances of the company and upon its future prospects. If you refer to the credit side of the general balance-sheet you will find the "amount owing to the company" is £12,249. Now that shows, as compared with the previous year, an increase of £433, but that increase is, in fact, more apparent than real. The sum outstanding at the end of 1860 was equal to 4½ months income, whereas at the end of 1867 it was equal to only 3½ months income; therefore, in point of fact, it has been reduced. The next item to which I wish to call your attention is that of "Goods *in transitu*," which amounts to £8710. It is a large sum, and is represented by coals, retorts, fireclay goods, oxide of iron, and lime, and it forms a part of the sum which, on the other side of the account, you find put down in the amount owing by the company in London. I next come to the stocks in hand, which in round numbers amount to £50,000. In 1866 the amount was £43,073; in 1867 it was £49,229, being an increase in the latter year of £6156, and I now proceed to account for the difference. The increase in the stock of sun-burners, tubings, and fittings amounts to £2167; the increase in the stock of coals amounts to £2451; in the coke and tar the increase is £450; the remainder is made up of new mains, services, and tools. If you turn now to the debit side you will find the "Amount owing by the company in London" is £13,616. In 1866 the amount under this head was £9821; therefore these accounts show an increase of £3795 in this respect. Of this sum of £13,616, our liability for freight and coals shipped from here and from Australia, but payable in London, amounts to £5867. On Dec. 31, 1866, we had 2406 tons of coal afloat; on that day in 1867 we had 5146 tons afloat, or more than double the quantity, which will account in a great measure for the difference in the amount. Under the head of "Wear and tear account" we have set down the sum of £1000. This is a very important item, and the directors, after consultation with Mr. Hawksley, considered this sum was sufficient, there having been actually expended on repairs in addition the sum of £1223. Turning to the "Profit and Loss account," you will find on the debit side that the quantity of coals carbonized during the year amounted to 5983 tons, at a cost of £18,457, being equivalent to nearly £3 1s. 6d. per ton. That is a very large sum;—the proportion is about the

same in 1867 as it was in 1866,—and it is due to the enormously high freights we have had to pay. I am happy to say that there is an improvement now both with regard to the cost of freight and the price of coal. Owing to the reduction of freights and landing charges the coal costs us at present from 4s. to 5s. per ton less. The next item is "Wages, maintenance of retorts, and tools, £2255," and making up with the cost of coals carbonized £20,712. This sum of £2255 is made up in this way—wages, £1329; maintenance of retorts, £598; fire-clay materials, £115; and tools, £213. Out of this there goes for repairs and renewals £925, and the sum specifically charged in the account under the head of repairs £298, so that the sum we have actually paid for maintenance of retorts is £1223. The sum set apart for wear and tear is £1000, so that the total expended and set aside out of the profits of the year is £2223. The next item probably which will strike you is the item of "Bad debts." It amounts to £195, which I think, looking at the embarrassment and the widespread ruin which have long prevailed in Bombay, cannot be considered as the subject of complaint upon an income so large as ours. We then come to the item of "Loss on exchange," amounting to £817. During the whole of last year the exchanges were adverse to this company. I have taken the best advice I can upon the subject, and consulted with Mr. Beattie, the assistant manager of the Chartered Mercantile Bank of India, but I do not see how it could possibly have been avoided. Turning to the credit side of the account, I come to something which I think you will consider satisfactory. The first item I call attention to is the "Gas and meter rental"—a very important item, as from this we derive the sinews of war, and nearly all our profits. In 1866 the rental, in round numbers, was £14,000; in 1867 it was nearly £30,000. The actual increase is £16,446, so that, in point of fact, the rental has more than doubled.

A PROPRIETOR: The rental in 1866, according to the accounts, was £17,000.

The CHAIRMAN: But those accounts ran over a period of fifteen months instead of twelve, and I thank you for giving me the opportunity to mention that fact. The coke sold during the year 1867 produced £4501, being an average of £2 12s. 4d. per ton; in 1866 the coke produced £3310, being an average of £2 8s. 7d. per ton; so that last year there was a very satisfactory increase in the rate per ton and in the total amount realized. The tar in 1866 produced £145; in 1867 it produced £649, being an increase of £502. I may add that there being no chemical works in Bombay, and it being inexpedient for this company to enter upon that department of business, we have no means of utilizing our other waste products. The use of tar is nearly new in Bombay, and it requires some time to make it known. We have by advertisements and in other ways created a demand for it, and we have now entered into a contract for 25,000 gallons with a responsible person, to be delivered at certain times, which we believe we can easily accomplish, and the price we obtain is 8¼d. per gallon. We have reserved to ourselves the right to sell above a certain price, and we believe that we shall realize a considerably increased revenue from this item of tar. The next item is an item of profit which we made upon coals, of £4488. It was Australian coal, which cost us £2137, and which we sold for £6095 14s. 3d., to which is added the sum of £530, received from the underwriters, being profit on coals sunk, making altogether £4488 2s. 1d. We now come to the item of fittings. In 1866 the profit on fittings was £4650—a very considerable sum; but you must recollect that that included the profit on the sale of lamp-posts to the municipality, and the very large quantity of fittings sold during the fifteen or sixteen months preceding the lighting of Bombay with gas. In 1867 the profits on fittings dwindled down to £601, and the reason for that I will explain. We were strongly advised by our manager in Bombay, and by every one whom we consulted, that it was desirable to reduce the cost of fittings to a minimum, especially as we wanted to introduce our gas freely among small consumers, to whom the price of the fittings was almost prohibitive. We are now supplying them at almost a nominal profit—not at a loss, but only a little above cost price. The next item is £2478 for "Incidental receipts." In 1866 the profits under this head were £1203; so that there has been an increase of upwards of £1200. The net profit of the company for the year is £8268, and of which it is obvious the sum of £4488 arises from our fortunate sale of coal. Now, gentlemen, turning to our prospects for the future, the report shows that there has been an increase in the private lights of 3382, and a decrease in the public lights of 434, and the report explains the reason of this decrease. It is this: we are bound to charge to the municipality, as to the private consumers, the sum of 7 rupees per 1000 cubic feet. That is a larger price than we should be willing under other circumstances to charge the municipality, but, inasmuch as they require us to light the public lamps in a most exceptionable and irregular manner, the consumption of gas is not so steady and uniform as it is here. For about eight nights in every moon the lighting is merely nominal, and during the remaining nights of the year it fluctuates according to the time of the moon rising, so that we have to heat and let down our retorts with considerable damage to them and consequent loss to ourselves. We are sorry to exact such terms from the municipality, and, as soon as we can see our way to a reduction, we shall be happy to make it. The municipality seem to feel that the price is very high, and they have accordingly reduced the number of the public lights, though I confess that that is not a matter which has caused us any uneasiness, as we were making little or no profit by them. Reverting to the report, you will perceive that the quantity of gas sold in 1867 was 46 million cubic feet as compared with 29 million cubic feet in 1866, which is a very satisfactory increase. The leakage in 1866 was 6 million cubic feet, or about 18 per cent., and that was reduced in 1867 to 5 million cubic feet, or 10 per cent., showing a saving in this respect of 8 per cent. The increase in the quantity of gas sold, upon the figures I have given you, was upwards of 60 per cent. I hope that will not be considered altogether unsatisfactory, looking at the great commercial embarrassment which has prevailed in Bombay. Now, as regards the prospects of the current year, the increase in the value of gas sold during the first four months, comparing them with the first four months of last year, according to the manager's returns, was £2100, the amount in 1867 being £8954, and in 1868, £11,054. The coke sold during the first four months of 1867 amounted to £1100, and in 1868 to £1900, showing an increase of £800. If we maintain the difference of only 3s. 6d. per ton in the cost of coal carbonized, as it is believed we shall do, assuming the consumption to be 6000 tons, our saving from this source alone will be £1050. An important increase in the profits of the company is to be looked for from the reduction of the establishment in Bombay, and by reduced rent, and diminished charges for landing and storing coals and goods. By the abolition of the licence-tax, and by the retrenchments I have mentioned, not less than £1500 a year has been saved, and we hope to effect still further reductions. One item, as I have already stated, has told seriously against us in the past year—viz., the item of exchange. We lost over £800 in that way. I hope the current year will show something in our favour. The chairman of the Oriental Gas Company stated at their last meeting that though for nine years they had realized a profit on exchange, last year, it proved a considerable loss to them. Well, gentlemen, looking at the prospects of our company, there appears to be a steady increase in the demand for gas in Bombay which is very assuring. The natives are coming in as consumers freely. If the increase is not rapid, it is at least steady, and we believe it will continue to grow. The cost of freights and the price of coal are considerably lower; the cost of the establishment has been much reduced; and all these things afford a reasonable hope and ground for expectation that we shall be able to maintain a satisfactory dividend for the future. I shall conclude by moving—"That the report and statements of account which have been circulated among the shareholders be received and adopted, and that a dividend at the rate of £2 per cent., free of income-tax, be now declared, making, with the interim dividend of 2½ per cent. paid in January last, a total dividend of 4½ per cent. for the year; that such dividend be payable on the 1st of July to the shareholders on the London register, and to those on the Bombay register three days after the arrival of the next outward mail."

Major STUART seconded the resolution.

Mr. SCOTT said the general charges, including salaries in India, and rents, rates, and taxes, amounted to £7410; last year they were about £6000, so that there had been an increase in these items of about £1400. The wear and tear was put down in the present accounts at £1000; last year it was £1602. This seemed to him to be a very undesirable reduction; for, if the larger sum was necessary to be laid aside last year for the maintenance of works, it was increasingly necessary this year. Everything depended upon the state of efficiency of the works to those who desired to hold a permanent interest in the company. It appeared that a report had been made to the directors by Mr. Berkeley as to the state of the works, and the company's affairs generally. Would there be any objection to have that report read?

The CHAIRMAN said the report was on the table, and the only objection to read it was its great length.

Mr. NODES expressed a hope that the accounts of the company would always be presented in a uniform shape, so as to enable the shareholders to make comparisons between the workings of one year and another. He also inquired whether the chairman was prepared to give an assurance to the meeting that the 4½ per cent. dividend for the past year had been really earned. He was induced, he said, to put the question because he unfortunately belonged to some companies which had been paying 10 and 15 per cent., obviously with the intention of getting the public to take up shares, but had now come down to nothing. Apart from the criminality of such a course, he thought there could be nothing more annoying to shareholders than to receive a certain rate of dividend at one time and nothing at all at another. He hoped, therefore, the chairman would be able to assure the meeting that the dividend proposed to be paid had been honestly and fairly earned.

Mr. STOKES said he had examined the balance-sheet, and he was sorry to find the result of the year's working was not so good as he had expected it would be. The net revenue of the company appeared to be £8268, of which £4488 was a profit made upon coals, which he supposed were sold to Her Majesty's Government. The profit derived from the sale of fittings was extremely small, considering the stock of fittings which the company had in hand. They had locked up the large capital of £29,080 in this one item, one quarter of which sum he should have thought would be sufficient for a company of this character to start with. Then, again, he thought the directors might now rely upon the judgment of their resident engineer for conducting the business at Bombay, and upon their own ability and that of their secretary for purchasing stores and managing things in England. None of the shareholders would be content with a 4 per cent. dividend, and the company were not even earning that; they ought, therefore, to be very economical and guarded in their expenditure, especially as next year they would not have the advantage which the Abyssinian War had given them in the past. He asked also for information as to what the "Incidental receipts, £2478," consisted of.

General RIGBY inquired whether the item of "Interest, £2424," in the balance-sheet, referred to money paid by the company on that account; also whether the £1000 charged in the profit and loss account, under the head of "Wear and tear," had been placed to a depreciation-fund and invested. One of the directors had retired since the last meeting. Was that any saving, or did the remaining directors still divide the same amount of remuneration that they formerly did? He was pleased to hear the chairman say that a considerable saving was to be effected in the charges at Bombay, but he could not help thinking, looking at the profit and loss account, that the charges in England were unnecessarily high, and, if the shareholders were ever to get a fair interest on their investment, there must be a reduction upon those charges also. Now that the works were finished so many directors were not required, and a portion of the expense for office-rent he thought might be economized, considering the amount of business required to be transacted there. The concession was only for twenty years, of which period six years had elapsed. For four years the shareholders received dividend out of their own capital, and now that the work of lighting the capital of Western India was accomplished they were only actually receiving 2 per cent., because more than 50 per cent. of the dividend for the past year was derived from the profit on an extraordinary sale of coal. He thought that for money invested in the lighting of a place like Bombay they were entitled to look for a fair return. The municipality had never behaved handsomely to the company, and the Government had acted in the most shabby way towards them from the commencement. They made the company pay a high price for their land, they compelled them to pay import dues on all their plant, and subjected them to many charges which they did not impose upon the Calcutta Company.

Mr. BISCHOFF inquired whether the amount put down for the stock of fittings—£29,080—was the cost price of those things or the result of an actual valuation.

The CHAIRMAN said he would reply to the various questions put to him *seriatim*. Mr. Scott contrasted the amount of the general charges last year —£7410—with those of the previous year, which amounted to about £6000, and inquired to what the increase of £1400 was due. In explanation he would state that the increase was due to the fact that several European fitters had returned during the past year, and an equal number had been sent out from this side. Of course the company had to pay the expense of the passage of their fitters both out and home—if they conducted themselves properly during the period of their service.

Mr. SCOTT said the reason why he put the question was, that he understood the chairman to say the directors had effected a saving of £1500 under this head.

The CHAIRMAN said the honourable proprietor had misunderstood him. What he intended to convey was, that the directors had effected retrenchments which would tell to that extent in the current year. He was then speaking of the future prospects of the company, and he thought he had put the saving at the lowest sum when he specified that amount. As to the wear and tear account, they had estimated the amount to be placed to the

credit of that fund at £1000 upon the advice of Mr. Hawksley. As to the question of Mr. Nodes, respecting the form of the accounts, it would be remembered that at the last meeting some dissatisfaction was expressed with the form of the accounts. It was stated that they were not sufficiently comprehensive and explicit, and some suggestions were made by Mr. Harrison which had resulted in the directors now giving a profit and loss account, and in a considerable amplification of the accounts generally. He believed the accounts were now as nearly perfect as they could be; and, admitting the desirableness of preserving uniformity in the accounts from year to year, because of the facility it afforded for purposes of comparison, he thought he might speak for the directors as a whole when he said they would follow the same course on all future occasions that they had done on the present. Mr. Nodes asked whether the dividend had been fairly earned. He (the chairman) had no hesitation in giving the strongest assurance on that point. The accounts from Bombay had been most rigidly examined. The auditors, who were both present, were very capable men, and men of great experience. One of them was a professional accountant, and the other was an auditor of one of the large metropolitan gas companies. They had carefully investigated the accounts, and he knew they would support him in the statement that the dividend was one which had been honestly earned. He need scarcely say that he himself would be sorry to be a party to any transaction which would reflect dishonour upon him hereafter. In reply to Mr. Stokes, as to the item of fittings, he must candidly admit that the stock amounted to a very large sum; and, if the directors could have foreseen that there would not be so rapid and extensive a demand for fittings before they incurred this liability, they would not have done it; as it was, they must now make the best of it; and, though, perhaps, it might appear an unfavourable feature in the accounts, he could only say the directors had acted according to the best of their judgment in the matter. Mr. Hawksley himself expected there would have been a much larger demand for fittings than there was, and the directors made provision accordingly. As to the profit on the sale of fittings during the past year being so small, he had forestalled the reply by the statement in his opening address that the directors had been endeavouring to promote the sale of gas, and, to the class of persons among whom they were pushing it, it would have been prohibitive if they had charged 25 per cent. profit upon the cost of the fittings. It must be remembered that the cost of fittings in England was a very different thing to what it was in Bombay, after payment of the expenses of conveying them there. He should have been glad if they could have made a larger profit, but he thought the directors had acted wisely in the course they had taken to supply fittings at a reduced price. Fully three years ago they gave directions to Mr. Proud to rent out fittings to small consumers, but they did not find that course help them at all. As to the inquiry respecting the incidental receipts, they amounted to £1983 last year, and they arose from legitimate trading operations of the company. He now came to General Rigby's question as to the item of interest, £2424. That, in point of fact, was money received. The directors had had at various times a considerable sum of money in hand, and they had utilized it by placing it on deposit bearing interest. As to the £1000 for "Wear and tear," that had been already explained. It was placed to a depreciation-fund, and the directors had the amount yet in hand. The next inquiry related to the directors. It was true that one of the directors had retired from the board, upon his appointment to a highly lucrative post at Liverpool; and the other directors, feeling themselves capable of doing the duty, had not elected any one in his place, and they had divided his remuneration among themselves. He did not think that in this the shareholders would have legitimate ground for dissatisfaction, when they looked at the fact that the directors only received £800 a year, that they met once a week, and even oftener, and that they gave up other considerable portions of time to the service of the company. As to the charges in England being unnecessarily high, all he could say was, that in taking the offices they now held they kept to much the same, or even a less, expense than they were at before. The present offices were very convenient—they were centrally situated, and it was always a consideration with a public company that they should have some regard to the convenience of the members of the Stock Exchange, who have to effect transfers, and of shareholders having business to do at the office. General Rigby was under a misapprehension as to the concession. A concession was promised to the company, but none granted. As to Mr. Bischoff's question, he might state that Mr. Berkeley, the consulting engineer of the Great Indian Peninsular Railway, had gone over the company's stock, and furnished the directors with a report. There had been misgiving in the minds of some members of the board whether the stock for which the company had paid was in existence, and a thorough investigation was determined upon; the fittings were found to be there, and, as he (the chairman) understood, they were set down at their cost price.

Mr. Nodes said, with regard to the remuneration of the directors, he could not but think they were either underpaid before or overpaid now. He would be one of the last to wish that the directors should give their services for an inadequate remuneration, but, as it was important that the expenses of this company should be kept within as narrow a compass as possible, he felt that the question raised should receive the consideration of the board, and that until 5 per cent., at all events, was paid to the shareholders, the directors should not take so large a sum as £800 a year.

The Chairman replied that the Articles of Association provided what should be the amount of the remuneration, and he certainly thought it was not too high, considering the serious responsibilities and the onerous duties which the directors took upon themselves in the interests of the company.

A Proprietor desired some further information respecting the fittings. From the statement made by the chairman it appeared that Mr. Berkeley satisfied himself they were all there, but it was not stated whether their value was ascertained to be what was put down in the accounts. If that fact had been ascertained he should like to be assured of it, and also to be informed how long it was likely to be before the stock would be sold, or whether the directors intended to have any portion of them sent back to England.

The Chairman said the fact (as he had already stated) that the fittings were all there had been ascertained, and their value had been put down at the cost price. The question had been raised whether the directors should sell them by auction, and so create a demand among the tradesmen of the town; but they had come to the conclusion that it was not advisable to force a sale of them. There was a continual demand for fittings, and the directors were constantly sending out fresh fittings upon requisition, and they were included in this stock.

Mr. Hawksley said to the best of his knowledge, as the engineer of the company, the facts were these, that the company held a large stock of fittings provided for all possible contingencies. It was expected, no doubt, in the first instance, and such was the information received, that the excitement among the people and their desire to obtain a supply of gas were very great, and that, on account of their wealth, they would require the most splendid gaseliers and fittings that could possibly be obtained. The consequence was, no doubt, that these things had been sent out to Bombay in too large a quantity, and of a quality too good for the present condition of the place. And this was a circumstance which the directors could not very well prevent, because they were not only advised by gentlemen who were intimately acquainted with Bombay by reason of residence there, but they were advised by natives of Bombay, and also by their local engineer, as to what fittings it would be desirable to send out. Therefore, although it was his distinct opinion that too many fittings had been sent out, and fittings of too great a value for the present time and circumstances, he had no doubt that eventually they would come into use. Beyond this, there had been some change with regard to the tastes of the people of Bombay. It was supposed by everybody, and the directors believed in the truth of the information, that the taste in Bombay was for glass goods, consisting of bright pendants with a great deal of colour about them. Goods of that kind were sent out, but somehow or other one or two sun-burners were imported, and those sun-burners took the people so wonderfully that they made a dead run upon them, while the gaseliers which had been sent out remained in the hands of the company. Probably they would remain there for some time, but they would gradually be disposed of. With regard to another part of the question put by the honourable proprietor, he might state that doubts arose in the minds of the directors, in which he participated, as to whether all these fittings, having been removed from a great number of ships into temporary warehouses in the town, and afterwards to the company's premises, and changed about from time to time in a variety of ways, could all be found, and whether many of them were not altogether absent, and whether, perhaps, they were not deluding themselves, and valuing in their books a stock of fittings many of which could not be produced. The directors therefore engaged the services of Mr. Berkeley, who was so good as to undertake, by means of his people, to ascertain whether or not the fittings were there. They were found to be there, but Mr. Berkeley had nothing to do with the valuation of the fittings. The way in which he understood them to be locally valued was that they had been charged in the books at the cost price, *plus* the expense of carriage and certain expenses of storeage which it was proper to put upon them. This represented the £29,080, and anything that could be got for them beyond that would be profit; anything short of that amount would, of course, be a loss. But an endeavour was being made to dispose of those fittings whenever an opportunity offered, and he had no doubt in the end they would all be disposed of probably at a nominal profit, though meantime there was the loss of interest on the money invested. For himself he might say that he had very little to do with the fittings beyond giving the necessary orders. The best opinions that could be taken were taken by the directors, and after much deliberation the orders were given. Up to a certain period, now a good while distant, he had charge of obtaining tenders for those goods, but for a considerable time past everything of that kind had been managed in the office of the company.

Mr. Stokes said, as this company was on friendly terms with other gas companies in those parts, they might perhaps do well to furnish them with drawings of some of the more costly fittings, to ascertain whether they could obtain a sale for them.

A Proprietor suggested that before the next meeting a valuation should be made of these fittings, so that the shareholders might be satisfied as to their real worth.

Mr. Hawksley said it would be impossible, under the circumstances he had mentioned, to fix upon these fittings the price at which they might be sold five or six years hence. As he had already stated, they would probably all be sold, though not so rapidly as was at first expected.

The Chairman, in answer to an inquiry, said the fittings were all properly stored and taken care of.

The motion was then put, and carried unanimously.

On the motion of Mr. Young, seconded by Mr. Collier, Major Suart was re-elected a director of the company.

Major Suart returned thanks on his re-election.

Mr. Gordon proposed the re-election of Mr. Lysley as a director.

The Chairman seconded the motion, which was carried unanimously.

Mr. Lysley having returned thanks, the retiring auditors were re-elected, and 25 guineas each was voted as their remuneration for the past year.

Mr. Deeley returned thanks for himself and brother auditor.

On the motion of Mr. Stokes, a vote of thanks to the chairman and directors for their services during the past year was cordially adopted.

The Chairman, in acknowledging the vote, said: On behalf of the directors and myself, I beg to acknowledge your cordial vote of thanks, and to give you our best assurance that we shall continue to give, as we have hitherto done, our utmost attention to the interests of the company. I think it right to say that, before we meet again, we shall have occasion to make a call upon the last issue of shares. Our working capital, looking to the large amount of coal we have afloat, is not equal to the requirements of the company, and if the rate of money in the market should go up, we should have to borrow at a disadvantage.

The proceedings then terminated.

BRITISH ASSOCIATION OF GAS MANAGERS.

Tuesday, June 2.

ON SOME OF THE CONSTITUENTS OF COAL GAS.

Lecture by Dr. Odling, F.R.S., F.C.S., &c.

Ever since the French Exhibition of last year there has been much public talk and discussion about the decline of English scientific manufactures, especially in relation to those of the Continent. It has been asserted very boldly that we in this country—where gas lighting took its origin, where the first locomotive ran, and where some of the earliest and greatest successes of the electric telegraph have been achieved—are not making such a degree of progress in scientific manufactures as continental nations are. Now, whether this be the fact or not—and for my own part I am by no means disposed to admit it as a fact—the circumstance of such an allegation being made is, I conceive, a warning to us that we must for the future devote our best energies and wisest consideration to the development of our different scientific industries. Now-a-days the universal panacea for every short-coming appears to consist in the establishment of what are called technical schools. It is difficult for outsiders to form an exact notion of what is to be the character and purpose of these technical schools, but the prevalent opinion, as I understand it, is something of this kind: Hitherto our mode of teaching young men the business of their future lives has been altogether wrong, and we must at once resort to an entirely different system. Instead of letting them learn their business at factories where work is done for a profit—where it is done in the only way in which it can be done on a large scale, and for useful purposes—they are to learn their business at special schools, where all work is to be done solely or primarily with a view to education. Henceforward, instead of gas managers learning the business of gas manufacture at actual gas-works, they are to study at model gas-works;

metallurgists at model smelting-works; and mechanists at model foundries and workshops. Now, in common with many of my scientific friends, and more especially Dr. Williamson, who has devoted much valuable thought to the subject, I venture to dissent very strongly from these views. I hold, and I think you will agree with me, that the only place in the world where you can learn to make gas properly is in an actual gas factory, and the only place where you can learn to make and work iron properly is at some actual iron-works. But with regard to science the case is very different, and instead of founding technical schools to teach manufacturing art, I believe it would be of much greater advantage to make the principles of science a far more prominent subject of study at our ordinary schools, so that when young men enter upon their work as manufacturers, they may be able to apply to their respective businesses the exact scientific principles which they will have acquired by the study of abstract science elsewhere. Let science, then, be taught in schools, and the application of science in works conducted on ordinary commercial principles.

These remarks are preliminary to what I have to say to you this evening. I do not come here pretending to teach you how to make or purify gas, for you know that much better than I do; but, inasmuch as gas-making is your business, and chemistry is mine, I want to tell you a little about the mere chemistry of your manufacture, and possibly throw out a hint or two that you may be able practically to apply. I wish to point out to you the purely chemical qualities of some of the bodies with which you are dealing, leaving you to make the application of the knowledge, as you are so well able to do. And, even in this limited matter, I am placed in considerable difficulty, for I find that my friend, Dr. Letheby, has gone pretty nearly over the whole of the ground in his previous lectures to you. I have read four of those lectures, and certainly with a great deal of profit, but I cannot say altogether with pleasure, for it is not a pleasant thing to find that, if not all, at least the finest plums have been already plucked from the tree. I can only attempt, therefore, to go a little more into chemical detail than Dr. Letheby has done with regard to some of the principal constituents of coal gas, and I purpose confining my attention almost exclusively to those constituents which do not contribute very largely to its illuminating power.

The first of these to which I will direct your attention is hydrogen. Hydrogen is an important constituent of ordinary coal gas, and its proportion varies very considerably in gases of different manufacture. It ranges from 12 to 50 per cent., and more frequently approximates to the higher than to the lower quantity. In ordinary London gas the proportion is usually about 40 per cent. Hydrogen gas is characterized by its burning with an almost invisible flame. I have here a jet of the burning gas, but, unless I introduce into the flame a piece of platinum wire, I doubt very much whether those gentlemen who are sitting at a distance can distinguish it; and, even with the piece of platinum inserted, the flame is scarcely visible.

In addition to the non-luminosity of its flame, hydrogen is very interesting, for this reason, that it is the only constituent of coal gas which, whether burned at a high or low temperature, with excess or deficit of air, yields the same product of combustion. I want to give you an illustration of the mode of burning hydrogen at a low temperature, and that I can readily do by bringing into contact with the pure gas as it issues from the jet a piece of platinum sponge mixed with a considerable proportion of clay. On bringing this into contact with the hydrogen, you see that the ball of platinum-clay soon becomes feebly red hot. Under these circumstances a small portion only of the issuing hydrogen is being burned, but that small portion so burned is being as completely converted into water as it would be in the oxyhydrogen blowpipe. At present the platinum ball, though very hot—just below a dull red heat—is not sufficiently hot to inflame the hydrogen. In order to effect the inflammation we must bring the light of a flame into contact with the gas, when it at once takes fire, as you perceive. This is the only point upon which I have to offer any remark on the subject of hydrogen—viz., that it may be burned at a high or low temperature, with flame or without, but the product of combustion is always the same—viz., water.

The next constituent of coal gas to which I shall refer is marsh gas, the most abundant, indeed, of all the constituents. It forms generally from 30 to 60 per cent. by volume, and burns with a pale luminous flame. We have here some marsh gas, though not quite pure, and you observe that it burns with a yellowish flame, having but a slight luminosity. I now want to give you an illustration of the mode of burning this gas at a low temperature. In this case, instead of employing platinum sponge, I shall employ a piece of platinum foil. There is, you perceive, a very considerable degree of heat produced during the operation, but not sufficient to inflame the marsh gas, although the platinum foil becomes distinctly red hot. Now, when marsh gas is burned thoroughly it yields products which consist almost entirely of carbonic acid and water, but when it burns in this way it gives rise to ill-defined products, which have an acid reaction, a disagreeable smell, and a power of reducing certain metallic salts. It is of very great importance, in burning coal gas, that you should get as thorough a combustion as possible, because all these half-burned products have an offensive smell, and it is to their presence that the smell of artificially-illuminated rooms is due.

I will now repeat this experiment with the platinum foil, but instead of taking marsh gas I will employ hydrogen, and you will see that directly I bring the foil into contact with it the gas inflames, the hydrogen being much more easily set fire to than the marsh gas. It is a striking property of hydrogen, as compared with marsh gas, that the degree of temperature which is not sufficient to inflame the latter inflames the former very readily; but though this is true of hydrogen in a pure state, it is not true of it when mixed with the other constituents of coal gas. It is sometimes suggested that because hydrogen gas is capable of being inflamed at an exceedingly low temperature, therefore its presence renders coal gas very inflammable; but such is not the case, for though the coal gas we have here contains 40 per cent. of hydrogen, we may make this piece of platinum foil suspended over it exceedingly hot, and yet it will not set fire to the gas; whereas when we were employing pure hydrogen, even though the platinum became but just visibly red, it was sufficient to inflame the gas, but diluted as the hydrogen now is to a large extent with marsh gas, the far more strongly heated platinum fails to inflame it.

And this leads me to make an observation or two upon the general nature of flame. I, who stand a little above the imperfectly burning coal gas, have the disadvantage of the smell which arises during the imperfect combustion. Some of you will remember that a little time ago, when large massive iron burners were employed for heating purposes, they also gave rise to a very offensive smell. Now, there is an impression abroad that although when gas is burned with an insufficient supply of air you do not burn it thoroughly, yet that if you burn it with an excess of air you cannot fail to effect its thorough combustion. But with all those iron burners the gas was burned with an excess of air, and the proof was that you only got a blue non-luminous flame; nevertheless you did not produce anything like a complete combustion of the gas into carbonic acid and water, as evidenced by the offensive smell of the products actually formed. The same thing frequently happens with the Leslie burner when used improperly. When a rich gas is employed, and the chimney is properly adapted, the combustion of the gas is as perfect as possible; but this is not the case in burning from a foot to a foot and a half per hour, when you only get a blue flame just tipped with yellow. Although the gas is then being burned with a large excess of air, you are, nevertheless, not so thoroughly burning the gas as when there is a less proportion of air. We shall readily see how this must be so. In every flame, you may take it, there is an interior portion or core, which is the gas itself; surrounding that is a mixture of air and gas in about the right proportion to give a luminous flame, and around that there is an external film of gas, with air in excess. In the intermediate portion of the flame the combustion is most perfect, though far from complete, and the temperature highest. The core of coal gas surrounded by this intermediate extremely hot layer is decomposed by the heat to which it is exposed, just as it would be decomposed in a white hot retort. The decomposed gas is then burned to a more or less complete extent in the intermediate luminous cone—never to a complete extent, since it is always burned with a deficient supply of air, being separated from the surrounding air by the external non-luminous film in which the air is in excess. But even in this external film the perfect combustion of the residual gas is never absolutely achieved, and for several reasons—first of all, because the residual gas is mixed up with so large a quantity of air which requires to be heated to a much higher temperature than the amount of heat in the flame is capable of imparting to it; and, secondly, because the residual gas and air are also necessarily mixed up with the incombustible products of the gas that is already burnt in the luminous cone. Accordingly, in the exterior film, notwithstanding the large excess of air, the combustion is not complete, because of the cooling effected by the large excess of air, and because of the diluting effect of the products of combustion.

Now, it will be found that the complaints which arise about the closeness of rooms heated by gas arise partly from the amount of steam produced, which makes the atmosphere damp, and interferes with free perspiration, and partly from the formation of imperfectly burned products, since in all lamps and candles the combustion is never perfected. There are always some half-burned products thrown off which give rise to the sense of closeness which is not peculiar to gas, but is noticed chiefly in the case of gas, because gas being the cheapest of all illuminating agents, we are apt to burn it most extravagantly.

Now, I want to give you some experimental illustrations of the nature of flame. Here I have a flask, which is supplied with coal gas from an opening blown in its side. At the bottom of the flask is an open tube communicating with the atmosphere, and you will find in this case that we can burn atmospheric air just as well in coal gas as we can burn coal gas in atmospheric air. You see, in fact, that the combustion takes place wherever the two layers come in contact with each other. Here we are burning the gas in air; in the other case we are burning the air in gas. In each case we have in reality a shell of flame, the difference being that in the one case the air is on the outside; in the other it is on the inside. By blowing gently into the air-tube you observe that I am actually able to burn my own breath in an atmosphere of coal gas, just as I might burn a small jet of coal gas in the atmosphere of my mouth. Now, let me give you another illustration of the nature of the combustion of coal gas. We have here a cylinder of coal gas, and in it I may burn any highly oxidized salt. I may burn, for instance, nitre. Nitre will take fire and burn in coal gas, just as a sulphur match will burn in air. In this case I am not going to burn nitre, but chlorate of potassium, which is a more convenient salt. I make the chlorate just red hot. You observe it does not burn at all in the air, but directly I introduce it into the coal gas it bursts into flame. Here, again, it is simply a question of where the two reacting bodies come in contact with each other. In ordinary circumstances we have the combustible match surrounded by oxygenous air; here we have the oxygenated salt surrounded by combustible gas.

In the Bunsen burner air and coal gas are mixed together before their combustion, whereby we get an almost solid flame; but even in this burner the problem of perfect combustion is not absolutely achieved, nor is it in the best contrivances with which I am acquainted. I believe the most perfect combustion practically attainable takes place in those luminous flames where you do not, indeed, get the maximum yield of light, but where the gas is a little over-burnt with production of a very white flame, as in some of the different forms of button-burner, in Leslie's burner, &c.

The next constituent of coal gas to which I wish to call your attention is ammonia. The proportion of ammonia in London gas is very small. We find that one grain of ammonia in 100 cubic feet of gas is sufficient to affect turmeric paper; upon which, ordinary London gas is usually without, or almost without, action. Ammonia is a very interesting substance to gas manufacturers. Of all the common gases—*i. e.*, of all gases which are not chemical curiosities—it is the one most soluble in water. At mean temperature, 1 cubic inch of water will dissolve 783 cubic inches of ammonia. The dissolution of ammonia in water takes place with very great rapidity. I have here a sealed glass tube, filled with ammonia gas. On breaking the end of the tube under water coloured with red litmus, you perceive that the contained ammonia is absorbed in an instant, and the tube immediately and completely filled with the water, now turned of a blue colour by the action of the ammonia. This is a very striking experiment. It would seem at first sight to warrant the notion that, since one cubic inch of water will dissolve 783 cubic inches of ammonia, and dissolve it at this extremely rapid rate, the removal of ammonia from coal gas must be a very easy problem. But such is far from being the fact. The tube with which I have been experimenting was completely full of ammonia, unmixed with any other gas; but the tube I now hold in my hand contains but 75 per cent. of ammonia gas mixed with 25 per cent. of air. And you will observe how very much more slowly the liquid will rise up in this case. It makes a very great difference in the dissolution of a gas whether we are dealing with the gas itself pure and simple, or whether we have it diluted to a certain extent with air. I now break the point of the tube under water, and you see at what a slow, scarcely noticeable, rate the gas gradually dissolves, and the water consequently rises in the tube; so much so, that the complete solution of the gas will scarcely be effected by the conclusion of my lecture. Here you see how great a difference it makes whether you are dealing with ammonia by itself, or whether you are dealing with what is substantially ammonia, but which contains in admixture some 25 per cent. of air or coal gas. But, after all, in reference to the dissolution of ammonia in water, the difference in the rate of solution between a gas consisting entirely of ammonia and one consisting of ammonia to the extent of 75 per cent. is as nothing compared with the difference between this latter and a gas of which the ammonia amounts to a few per cents. only, such as that with which you have to deal.

I want to illustrate to you in another way the fact that the solubility in water of a gas by itself, and of the same gas when mixed with other gases,

s a very different thing. In illustration of this I would call your attention o the difficulty there is in dissolving up from the air substances which by themselves are exceedingly soluble. This is an empty 4 lb. bottle, and into it I am going to put a few drops of strong ammonia. Having done this I now introduce a glass rod moistened with a little muriatic acid, and by this means I shall produce an abundance of white fumes of sal ammoniac inside he bottle. The bottle soon gets full of them. Now, sal ammoniac is a very soluble substance indeed; but you will observe the difficulty which I have in dissolving up these fumes of sal ammoniac from the air in the bottle. I half fill the bottle with water, whereby, as you see, a good deal of the fume is blown out; nevertheless, though I shake the bottle about, the remainder does not disappear. You see what a difficulty there is in dissolving, not sal ammoniac itself, but sal ammoniac when forming, say, 1 per cent. or a half per cent. of air. Indeed, I have to shake up the bottle very violently and for some time, with this large excess of water, in order to get rid of the fume altogether. This shows that the mere passage of any gas over a considerable extent of watery surface will not be sufficient to cause its soluble impurities to be taken up, but that long contact or considerable agitation with the water is required.

I will now give you another illustration of the same difficulty. I have here a bottle containing strong ammonia, and here another containing sulphuric acid. The sulphuric acid is very much stronger than that with which gas managers are in the habit of washing their gas. It is of about the strength of ordinary brown acid; nevertheless you will see that on blowing through the first bottle I shall get a current of air charged with ammoniacal vapour, and that, on its passage through this comparatively strong sulphuric acid, the whole of the ammonia will not be removed. You perceive that the gas which has bubbled up through the sulphuric acid has, notwithstanding, the property of browning turmeric paper; and on passing it for a few minutes through red infusion of cabbage, the red colour of the liquid is turned successively purple, blue, and finally green. The strong acid, employed in this way, is quite powerless to remove from the air the ammonia which it has taken up by its passage through the solution of ammonia. This shows how very difficult it is sometimes to remove small proportions of ammonia, not only by a substance like water, in which it simply dissolves, but even by sulphuric acid, with which it enters into chemical combination. And this is true, not only of ammonia, but of all other impurities of coal gas: when they are reduced to small quantities it is most difficult to get rid of them entirely. The nearly pure gas requires to come into most intimate contact with the several absorbent substances employed, for a considerable length of time, in order to become entirely freed from impurity.

With regard to ammonia, I will show you one other experiment. Though, as I have said, this gas is so soluble that one volume of water will dissolve 783 volumes of ammonia, nevertheless it is very readily removable from water by the agency of air, or coal gas, or, indeed, any gaseous substance whatever. Accordingly you will find that even the weakest solution of ammonia will give off some of its ammonia upon agitation with a considerable volume of air. I will take two 4 lb. bottles, and half fill each of them with water. Into each of these bottles I will now suspend a piece of ordinary red litmus paper, just damped slightly. The one bottle contains pure water, and I do not expect to find the paper in it affected at all; but to the 2 lbs. of water in the other bottle I will add three drops only of solution of ammonia—*i. e.*, of ammonia gas already dissolved in about two drops of water—and yet this 2 lbs. of water will not be able to retain all the ammonia and prevent its diffusing into the air. Upon shaking up the bottle, the ammonia diffuses itself out of the water into the air above it, and in a few minutes you will see that the litmus paper (which I now suspend in the air of the bottle) has become completely blue, through the minute proportion of ammonia in the water having partially escaped into the air above it.

I will now direct your attention to the mode in which ammonia combines with acids to form salts. Of all metallic salts chloride of sodium, or common salt, is the most familiar, and may conveniently be taken as the type. It consists of one proportion of sodium, having the relative weight 23, combined with one proportion of chlorine, having the relative weight 35. Writing each of these proportions by the symbols Na (natrium) and Cl respectively, common salt is expressed by the symbol NaCl. Now, it will be observed that common salt, or chloride of sodium, differs from muriatic acid, or chloride of hydrogen, HCl, in the circumstance of its containing a proportion of sodium, having the relative weight 23, instead of a proportion of hydrogen, having the relative weight 1; and in a similar manner it will be found that metallic salts in general are formed from acids by the substitution of metal for the hydrogen of the acid. Thus when muriatic acid is neutralized with caustic soda, Na HO, common salt is produced by the following reaction:—

$$H\,Cl + Na\,HO = Na\,Cl + H\,HO.$$

We begin with chloride of hydrogen, and end with chloride of sodium.

But the formation and constitution of ammonia salts are very different. In order to make sal ammoniac, or chloride of ammonium, I do not replace the hydrogen of the acid by any metallic substance whatever, but I combine the entire acid, hydrogen and all, with ammonia, thus:—

$$H\,Cl + NH_3 = NH_3\,H\,Cl.$$

And similarly with regard to the sulphate, nitrate, oxalate, and other salts of ammonia, they are all of them constituted of the original hydrogen acid, or hydrated acid, combined directly with ammonia.

But salts of ammonia present a very remarkable resemblance, in many of their properties, to ordinary metallic salts, more particularly to salts of potassium, and in a less degree to salts of sodium. Hence some chemists are disposed to regard ammonia salts as really containing a metal—not a simple metal like sodium, but a compound metal formed by the union of the ammonia with the hydrogen of the acid. Accordingly they represent sal ammoniac not by the forumla NH_3 HCl, but, instead, by the formula (NH_4) Cl; and they call it not muriate or hydrochlorate of ammonia, but, instead, chloride of ammonium. Now, there is one very striking property of ammoniacal salts which, so far as it goes, is strongly in favour of this view—which really seems to show that ammonia can unite with the hydrogen of muriatic acid to form a compound metal.

The evidence is of this kind: Mercury, which is the only metal existing in the liquid state at ordinary temperatures, is capable of uniting with many other metals, but with no other bodies than metals, to form semi-liquid or pasty alloys, which are called amalgams. Gold and silver, indeed, are usually extracted from their respective ores by the process of amalgamation. The precious metals are first dissolved in mercury; the excess of mercury is then strained or squeezed off, and the soft or pasty amalgam submitted to distillation. Now, when chloride of sodium is decomposed by the galvanic battery, chlorine is liberated at one pole and metallic sodium at the other, and if this other pole be formed of a drop of mercury, the sodium, as it is set free, is taken up by the drop of mercury to form sodium amalgam. Similarly, when chloride of ammonium is decomposed by the galvanic battery, chlorine is liberated at the one pole, while there is formed at the other, in presence of a drop of mercury, an abundant amalgam, which consists of nothing but mercury, ammonia, and hydrogen. Now, since amalgams are formed only by the union of mercury with metals, the production of an ammonium amalgam is some evidence that its constituents, ammonia and hydrogen, are contained in the amalgam in the form of a compound metal.

I am able to produce this ammonium amalgam in another form, and to show it you on a somewhat large scale. I have here some sodium amalgam already prepared by dissolving metallic sodium in heated mercury, and if I now pour this amalgam into a solution of chloride of ammonium, the chlorine leaves the latter salt to unite with the sodium of the amalgam and form chloride of sodium, while the ammonium takes the place of the sodium and unites with the mercury to form ammonium amalgam. You see, directly I pour in the liquid amalgam of sodium, the bulky pasty amalgam of ammonium is at once formed, which, expanding to some hundred times its original bulk from the evolution of interstitial hydrogen, speedily overflows the vessel. Accordingly, ammonia salts may be regarded either as direct combinations of ammonia (NH_3) with the hydrated acids, such as hydrochloric acid (HCl), sulphuric acid (H_2SO_4), &c.; or as derivatives of the several acids through a replacement of their hydrogen by the compound metal ammonium (NH_4). Which of these views is most correct must be regarded as an open question. Some facts are in favour of the one view, and some the other. Most chemists are now in the habit of employing both modes of representation alternatively in different cases.

Ammonia is a very interesting body in another relation altogether. It is of all uninflammable bodies the one which approaches nearest to being inflammable. Here we have, in this flask, some solution of ammonia which, upon being gently heated, furnishes us with an abundant supply of ammonia gas. On applying a light the gas burns, as you see, with a pale green flame, but on taking away the light it ceases to burn. The heat produced by its own combustion is not sufficient to maintain it in combustion, and it only burns in contact with the flame of some other body. But though it will not burn in air it will burn in oxygen gas, and I will now give you an illustration of the combustibility of ammonia in oxygen gas. On surrounding the jet of ammonia by a current of oxygen you observe that it burns, I might almost say, brilliantly, with its characteristic greenish-yellow flame.

Why does ammonia burn so freely in oxygen gas and so difficultly in air? There are several reasons, the principal one being that when the ammonia burns in air, for every one volume of oxygen which takes part in the action, and which has to be heated up to the temperature of the flame, there are four parts of nitrogen which have also to be heated up to the same temperature, but which contribute nothing to the action or the temperature. Moreover, when burning in oxygen, the jet of ammonia is at any given instant in contact with five times as much oxygen as when burning in air. I can give you another illustration of the combustibility of ammonia gas in a somewhat different form. I take a Florence flask, and into it I pour a little strong solution of ammonia. I now place over the strong ammonia a coil of platinum wire, which is first heated just to redness. You perceive that the platinum wire exposed to the ammonia continues to glow for a considerable time, and if I now pass into the gas a rapid stream of oxygen, ignition of the wire becomes more and more intense by reason of the chemical combination taking place between the ammonia and oxygen, and in a minute or two it becomes so hot as to inflame and explode the mixture of gases.

The fumes remaining in the flask are an evidence of the oxidation which has taken place, not only of the hydrogen of the ammonia into water, but of its nitrogen into nitrous or nitric acid. This is an important fact with regard to the combustion of ammonia, for we shall find, when speaking of sulphur in gas, that this sulphur is oxidized by burning into sulphurous acid only, which, when sufficiently diluted, is a very innocent substance; whereas if considerable portions of ammonia are present in the burning gas, the ammonia in burning yields different oxides of nitrogen, which effect a partial conversion of the sulphurous acid into sulphuric acid. In burning ammonia, then, we find that the hydrogen of the ammonia unites with oxygen to form water, whereas the nitrogen of the ammonia is partially liberated in a free state as nitrogen gas, and partly transformed into nitrous acid. Accordingly, we always get by the combustion of ammonia a certain amount of nitrous acid, which acts as a powerful oxidizing agent. In ordinary purified gas, however, the proportion of ammonia is so exceedingly minute—in most cases insufficient to affect turmeric paper at all—that this point respecting its products of combustion is not of any practical interest. There is one other mode of burning ammonia to which I will direct your attention for an instant, which has a more practical bearing. Although ammonia will not burn in air by itself, it will burn in air if mixed with some other inflammable gas. I am here burning some hydrogen gas, and now, instead of burning it directly, I will first pass it through strong ammonia, when you perceive that the size of the flame is very much increased, and its appearance entirely altered from the considerable combustion of the ammonia which the hydrogen has taken up. You see, therefore, that in removing the ammonia from your gas you do really remove a combustible, and even to some extent a luminiferous constituent of the gas.

Now a word or two with regard to another constituent of coal gas—viz., carbonic oxide. Carbonic oxide exists in ordinary coal gas to a comparatively small extent, the proportion varying from 5 to about 15 per cent. This gas is characterized by its burning with a feebly luminous but decidedly blue flame. I have here some of it in a holder, and you see the clear blue flame by which its combustion is characterized. We will now substitute for the glass tube an ordinary burner; but though I am using the largest sized bat's-wing, I am able to get but a very small flame, carbonic oxide being a gas which is very soon burned out. Now, although carbonic oxide exists to the extent of from 5 to 15 per cent. in ordinary coal gas, it exists in a much larger per centage in the gas that is produced by passing steam over ignited coke. You will remember that at one time there was a project for making illuminating gas by means of steam passed over coke. The gas so produced has itself no illuminating power, but we may give it an illuminating power by burning with it some luminiferous hydrocarbon, such as benzole, or by introducing into its flame a coil of platinum wire. Here we have a U-tube containing pumice and benzole, and we will now pass through it some of this carbonic oxide gas. You will see that it is a very excellent purveyor of the hydrocarbon, and that we thus get a very luminous flame, because carbonic oxide is the gas which, for an equal quantity of oxygen, gives out by its combustion the largest proportion of heat—larger even than hydrogen—in the proportion of 68 to 57. The other mode of giving illuminating power to the originally non-luminous flame, and which seems to some extent a considerable success, is by means of a coil of platinum wire. On holding this piece of wire in the flame it becomes of almost dazzling whiteness, and radiates light abundantly. I remember once seeing a room of the Royal Society illuminated in this manner for a few hours, and I think it is a question whether this steam gas may not, after all, be made something of. When steam passes over coke, the coke being

heated merely to dull redness, there is scarcely any carbonic oxide gas produced—it is nearly all hydrogen and carbonic acid. The kind of action is shown in this equation:—

$$C + 2H_2O = CO_2 + H_4.$$

But when we employ a full red heat the kind of action is different. Under those circumstances we have this reaction:—

$$C_2 + 3H_2O = CO_2 + CO + H_6.$$

So that after the removal of the carbonic acid gas by lime there is left a mixture of three volumes of hydrogen with one of carbonic oxide. There is a great prejudice against the use of carbonic oxide from its extremely poisonous character. An atmosphere containing only 2 per cent. of the gas will prove fatal to animals breathing it; but inasmuch as gas for illuminating purposes is meant to be burned, and not to be breathed, the question is not so much with regard to the poisonousness of the original gas as of the products of combustion. The amount of gas that escapes into the air unburned is so small that its presence may be safely disregarded.

Just one or two remarks with regard to carbonic acid. Carbonic acid gas is incombustible, and it has the property of extinguishing flame in a very remarkable degree. Further, a very small proportion of carbonic acid in coal gas lowers the illuminating power of the coal-gas flame to a great extent. It is estimated that the presence of 1 per cent. of carbonic acid in coal gas will diminish the illuminating power of the flame by 5 per cent. Now, this is a very curious observation, and requires some further explanation, which I think the following circumstances may afford:—Carbonic acid gas at a high temperature undergoes decomposition. In the interior of any flame carbonic acid ceases to be carbonic acid; it is decomposed into carbonic oxide and oxygen, so that in this way 2 per cent. of carbonic acid gas is equivalent to 1 per cent. of oxygen—or it may be said that 2 per cent. of carbonic acid is equivalent to 5 per cent. of air—and you know that an admixture of 5 per cent. of air will lower the illuminating power of gas very much. In this case a combustion takes place partially in the interior of the flame, instead of at the surface only; and by this interior combustion the luminosity of the flame is interfered with, in accordance with well-known principles. In order to obtain the maximum of luminosity, then, the admixture of oxygen, in the form of air or of carbonic acid, with the coal gas, should be as little as possible. Where coal gas issues under a strong pressure, it gets mixed up with air to such an extent that the flame is scarcely more luminous than that of a Bunsen burner; and, from the decomposition of carbonic acid gas into carbonic oxide and oxygen, the carbonic acid contained in coal gas interferes with the luminosity of the flame in the same way as would an admixture of air.

Carbonic acid may be further considered, not only as a constituent of coal gas, but also as a product of its combustion. That it is produced by the combustion of coal gas we may readily ascertain. If we pour a little lime water into a flask within which a jet of coal gas has been allowed to burn for a short time, the lime becomes converted into chalk, by its absorption of the produced carbonic acid, and we get at once a milky precipitate, as you perceive. But carbonic acid gas is produced not merely by combustion, but also by respiration. If I breathe into this bottle, already containing a little lime water, you see that I get at once a deposit of chalk or carbonate of calcium, just as in the last experiment of the burning gas-jet. Here a point of interest obviously arises in the consideration of the relative proportions of carbonic acid discharged into the atmosphere by the combustion of gas and the respiration of individuals. Time will not allow me to enter upon statistical details, but, speaking roughly, I may say that the air expired from the lungs contains between 3 and 4 per cent. of carbonic acid, and it is calculated that one man in an hour produces about as much carbonic acid gas as a burner consuming 6 feet of coal gas, or as two burners consuming 3 feet each. So that when it is objected that any two burners in a room are producing so much carbonic acid as to affect the atmosphere injuriously, you may turn out your neighbour or turn out the gas with equal relief, seeing that he contributes quite as much carbonic acid as the couple of burners. Now, the ordinary proportion of carbonic acid gas in the atmosphere is under a half part in a thousand—it is about ·04 per cent. The maximum amount that has been found in the gallery of a crowded theatre, for instance, where it may be assumed that the atmosphere is defiled to its utmost possible extent both by the combustion of gas and the respiration of individuals—each individual contributing as much as is produced by 6 feet of gas—has always fallen short of half a per cent., the highest determination made by Dr. Roscoe amounting to ·32. Apparently, when the carbonic acid begins to accumulate to this extent, ventilation takes place through crevices and porous walls (for walls are freely porous to the minute particles of gases) whereby the proportion of carbonic acid is kept down, and, as I have just said, it has never been known to reach one-half per cent.

Now this observation has a very important bearing upon some other facts, to which I will refer in a minute or two; but there is, first, one other remark I have to make with regard to carbonic acid gas. It is a liquefiable gas. Under exposure to high pressure and low temperature it is converted into a transparent liquid; and, in its liquid state, it presents a most remarkable resemblance in its properties to that terror of gas managers, disulphide of carbon. Liquefied carbonic acid gas (CO_2) and disulphide of carbon (CS_2) are both of them heavier than and immiscible with water, but miscible with alcohol and ether; and they are both of them excellent solvents for fats, resins, india-rubber, &c. Further, in considering the properties of disulphide of carbon, we shall find that it acts as an anhydrous acid, combining directly with bases to form definite salts, strictly comparable with the ordinary carbonates produced by the direct combination of carbonic acid with bases.

(To be continued.)

DR. WHITMORE'S REPORT ON THE QUALITY OF THE WATER SUPPLIED IN ST. MARYLEBONE, IN MAY, 1868:—

MAY.	Total Solid Matter in degrees or grains per Imperial gallon.		* Loss by Incineration of Solid Matter in previous column.		Ammonia.
	May, 1867. 0°	May, 1868. 0°	May, 1867. 0°	May, 1868. 0°	0°
Distilled Water . . .					
West Middlesex water	18·72	16·64	0·68	0·56	—
Grand Junction water	18·84	17·52	0·64	0·60	—

* The loss by incineration represents the amount of organic and other volatile matters contained in an Imperial gallon (70,000 grains) of water.

My analyses of the Thames water during the past month were made previously to the late storms and heavy rains, and show that our water supply has been highly satisfactory, both as regards clearness and purity. The quantity of organic and saline matter contained in it was considerably less than in the corresponding month of last year; this is owing partly to the dry fine weather which has prevailed, but partly also to the care bestowed by the companies upon its filtration. But it should be generally known, and ought not afterwards to be forgotten, that the water thus examined is taken directly from the companies' mains, and that if it be stored for any length of time in dirty butts or foul cisterns, or kept contiguous to dust-bins, water-closets, or other places where foul gases are generated, it very speedily becomes contaminated, especially in warm, sultry weather, and in this condition is frequently the cause of diarrhœa. Now is the time that every householder in the parish should have his water receptacles thoroughly cleansed and purified; if these receptacles consist of old wooden butts that are in any degree rotten or wormeaten, they should be replaced by new ones, taking care at the same time to have them pitched inside and well painted outside, and covered with a good cover, or what would be infinitely better, to substitute for the butt a good slate cistern.

AVERAGE COMPOSITION AND QUALITY OF THE METROPOLITAN WATERS IN JUNE, 1868.—The following are the returns of the Metropolitan Association of Medical Officers of Health:—

NAMES OF WATER COMPANIES.	Total Solid Matter per Gallon.	Oxygen required by Organic Matter, &c.	Nitrogen.		Hardness.	
			As Nitrates, &c.	As Ammonia.	Before Boiling.	After Boiling.
Thames Water Comps.	Grs.	Grs.	Grs.	Grs.	Degs.	Degs.
Grand Junction. . . .	16·70	0·088	0·056	0·001	11·8	2·8
West Middlesex	14·78	0·070	0·050	0·001	11·3	3·3
Southwark and Vauxhall.	22·13	0·117	0·072	0·002	12·0	3·5
Chelsea	17·86	0·075	0·106	0·002	11·3	2·4
Lambeth	18·60	0·083	0·105	0·002	12·5	2·6
Other Companies.						
Kent	27·02	0·024	0·305	0·001	17·6	6·0
New River	15·90	0·047	0·085	0·001	11·9	2·3
East London.	17·04	0·056	0·038	0·001	11·7	2·6

Note.—The amount of oxygen required to oxidize the organic matter, nitrites, &c., is determined by a standard solution of permanganate of potash acting for three hours; and, in the case of the metropolitan waters, the quantity of organic matter is about eight times the amount of oxygen required by it.

All the samples were bright, excepting that from the Southwark and Vauxhall Company, which was slightly turbid.

H. LETHEBY, M.B.

DR. FRANKLAND'S ANALYSIS OF THE METROPOLITAN WATERS IN JUNE, 1868.—"Royal College of Chemistry, June 25, 1868.—Sir,—I have the honour to submit to you in the following table the results of the chemical examination of the waters supplied to the metropolis during the month of June. For the purpose of comparison I append also the results yielded by Loch Katrine water, as supplied to Glasgow, and by the waters supplied to the towns of Lancaster, Manchester, Leicester, Preston, and Worthing, when submitted to the same analytical processes. The long continued drought has rendered the river waters supplied to London unusually pure. The previous sewage contamination of these waters is on the average much lower than has ever before been observed. The Southwark Company's water was again turbid from the presence of much suspended matter; besides giving the water a repulsive appearance, this suspended matter is nitrogenous, and therefore highly objectionable. With the exception of the East London Company's water, which contained however only traces of suspended matter, the rest of the samples were perfectly bright and transparent.

Companies.	Date and Place of Collection.	Temperature in Cent. Degrees.	Total Solid Impurity in 100,000 Parts.	Organic Carbon.	Organic Nitrogen.	Nitrogen, as Nitrates and Nitrites.	Ammonia.	Total combined Nitrogen.	Previous Sewage Contamination (Estimated).	Total Hardness.
Thames.	Temp. of Thames on June 12	Cent. 16·6								
Chelsea.	June 18—Cab Rk., Horse Guards . .	19·1	29·4	·148	·018	·113	·002	·133	820	19·7
West Middlesex	June 12—Cab Rk., Portland Road . .	18·9	23·4	·152	·023	·096	·001	·120	650	18·4
Southwark & Vauxhall . .	June 12—Barclay's Brewery	15·8	30·4	·192	·046	·107	·001	·154	760	18·2
Grand Junction	June 15—Cab Rk., Woodstock St. . .	18·9	24·6	·170	·026	·068	·001	·089	370	19·4
Lambeth	June 12—Cab Rk., Lambeth Road . .	17·5	24·8	·186	·022	·101	·002	·125	700	18·9
Other Sources										
New River . . .	June 12—Cab Rk., Tottenham Ct. Rd.	18·2	24·2	·063	·015	·096	·000	·111	640	18·2
East London.	June 12—Slater's, Old Ford Road .	17·5	24·4	·113	·019	·055	·000	·074	230	18·2
Kent	June 16 — Police Statn., Greenwich	13·6	41·8	·053	·007	·434	·000	·441	4020	27·8
Loch Katrine	Feb., 1867, Glasgow		3·28	·256	·008	·031	·002	·041	0	0·3
Lancaster . . .	Sept.—Lancaster .		3·54	·157	·001	·036	·001	·068	50	0·1
Manchester . .	Nov.—Manchester		6·80	·242	·026	·001	·001	·028	0	2·7
Leicester	Nov.—Leicester . .		23·7	·506	·020	·001	·001	·022	0	13·4
Preston	Dec.—Preston . . .		14·7	·515	·040	·001	·003	·044	0	6·7
Worthing . . .	Nov.—Worthing . .		36·7	·162	·000	·426	·000	·426	3940	23·8
Column 1	2	3	4	5	6	7	8	9	10	11

The numbers in columns 4, 5, 6, 7, 8, 9, 10, and 11 all relate to 100,000 parts of the waters. The table is to be read thus: The Chelsea Company's

water collected on June 18, at the Horse Guards cab rank, had a temperature of 19·1° Cent.; 100,000 lbs. of it contained 29·4 lbs. of solid impurity; the organic matter, constituting a portion of this impurity, contained ·148 lb. of carbon and ·018 lb. of nitrogen. This solid impurity also contained ·113 lb. of nitrogen in the form of nitrates and nitrites, besides ·002 lb. of ammonia; whilst the total amount of *combined* nitrogen in every form was ·133 lb. The above quantity of water supplied by the Chelsea Company had been, after its descent to the earth as rain, contaminated with sewage or manure matter equivalent to 820 lbs. of average filtered London sewage. By gradual oxidation, partly in the pores of the soil, partly in the Thames and its tributaries, and partly in the reservoirs, filters, and conduits of the company, this sewage contamination had been converted into innocuous inorganic compounds before its delivery to consumers. Finally, 100,000 lbs. of the Chelsea Company's water contained 19·7 lbs. of carbonate of lime, or an equivalent quantity of other soap-destroying ingredients.—I have, &c., E. FRANKLAND.—The Registrar-General, &c."

RAISING A WATER-MAIN.—An account is given in the *Brooklyn Eagle* of the raising of a 30-inch water-main in Broadway as much as 4 feet without interrupting the supply. The operation was rendered necessary to admit the principal sewer of the town to pass under the main, which had consequently to be displaced while the water was flowing through it, without causing a leakage at the joints. To do this, a length of 600 feet of main was uncovered, and a trench was dug 8 feet wide and about 7 feet deep. Eleven of Lyon's patent derricks were rigged up, from which strong chains were passed round the main, the total weight of which, with the water in it, being about 80 tons, besides having to overcome the adhesion of the mud in which it was embedded. The operation was one of great nicety, for the lifting force had to be so equally regulated that none of the pipes should be pulled out of the sockets. The main was in lengths of 9 feet, and as many as 60 of them had to be disturbed, and raised more or less. At one or two points the water leaked out, but not to a great amount, and the joints were soon made tight again. After eight hours of continuous slow and steady lifting, the work of raising the main to its required position was successfully accomplished, props being placed at several points to support it. The crown of the arch thus formed reached the old level of Broadway, the surface of which had consequently to be raised.

THE CORPORATION OF LONDON AND THE CITY GAS COMPANIES.—At the meeting of the Common Council on Thursday last, Mr. J. F. Bontems, chairman of the special Gas Committee, asked for and obtained authority to print a report of the proceedings taken by them in reference to the City of London Gas Bill, in order that it might be circulated amongst the members and taken into consideration on a future day.

Share List of Metropolitan Gas Companies.

Number of Shares issued.	Amount per Share.	Name of Company.	Amount paid up p. Share.	Dividend p. Cent. p. Annum.	Price per Share.
	£		£ s. d.	£ s. d.	£
8000	10	Anglo-Romano	10 0 0	10 0 0	11 — 12
5000	20	Bahia (Limited)	20 0 0	3 0 0	14 — 15
1000	20	Do., preference	20 0 0	10 0 0	20 — 22
750	20	Do., do., redeemable	10 0 0	10 0 0	.. — 12¼
40000	5	Bombay (Limited)	5 0 0	4 10 0	4 — 4½
10000	5	Do., third issue	3 0 0	4 10 0	2 — 2½
10000	20	British (Limited) (Norwich, Hull-Seulcoates, Hanley, Tunstall & Shelton [Potteries], Trowbridge, & Holywell.)	20 0 0	10 0 0	28 — 29
12000	50	*Chartered*	50 0 0	7 0 0	47 — 48
6000	50	Do.	45 0 0	7 0 0	41 — 43
10000	20	*City of London*, A shares	20 0 0	9 0 0	22 — 24
10000	10	Do., B shares	10 0 0	4 0 0	6 — 6½
9629	10	Do., new shares	10 0 0	9 0 0	11 — 12
25000	25	City of Moscow (Limited)	25 0 0	nil.	4 — 5
17490	25	*Commercial*	25 0 0	10 0 0	33½ — 34
20000	20	Continental Union	20 0 0	4 0 0	14 — 15
10000	20	Do., preference	20 0 0	7 0 0	20 — 20½
5000	10	*Crystal Palace District*	10 0 0	10 0 0	13½ — 14
5000	10	Do., preference	10 0 0	6 0 0	12½ — 13
10000	10	Do., new shares	2 10 0	7 0 0	2½ — 3
4000	50	*Equitable*	50 0 0	10 0 0	65 — 67
4000	25	Do., new shares	25 0 0	10 0 0	32½ — 33½
23406	10	European (Limited)	10 0 0	10 0 0	14 — 14½
12000	10	Do., new shares (Boulogne, Amiens, Rouen, Caen, Havre, & Nantes.)	5 0 0	10 0 0	7 — 7¼
20000	10	*Great Central Gas Consumers*	10 0 0	10 0 0	13 — 13½
5000	10	Hong Kong (Limited)	10 0 0	5 0 0	8 — 10
26000	50	*Imperial*	50 0 0	10 0 0	64 — 64½
26000	12½	Do., new shares	12 10 0	7 0 0	12¼ — 13
	12½	Do., new shares	3 0 0	7 0 0	3 — 3¼
1300	100	Do., bonds	£100	10 0 0	170 —175
28000	50	*Imperial Continental* (Amsterdam, Berlin, Ghent, Hanover, Lille, Rotterdam, Aix-la-Chapelle, Antwerp, Bordeaux, Brussels, Cologne, Frankfort-on-Maine, Haarlem, Stolberg, Toulouse, & Vienna.)	43 15 0	16 0 0	98 — 99

Number of Shares issued.	Amount per Share.	Name of Company.	Amount paid up p. Share.	Dividend p. Cent. p. Annum.	Price per Share.
	£		£ s. d.	£ s. d.	£
400	100	Imperial Mexican (Limited)	100 0 0	nil.	
200	100	Do., new	100 0 0	nil.	
3000	40	*Independent*	40 0 0	10 0 0	52 — 53
3000	10	Do.	10 0 0	5 0 0	7 — 9
3000	20	Do.	12 10 0	7 10 0	13 — 14
7133	50	*London*	50 0 0	10 0 0	63 — 64
5610	25	Do., 1st preference	25 0 0	6 0 0	26 — 27
503	50	Do., 2nd preference	50 0 0	6 0 0	
214	50	Do., 3rd preference	50 0 0	6 0 0	
£18781		Do., 1st preference stock		6 0 0	
£11828		Do., 2nd preference stock		5 0 0	
12000	5	Malta and Mediterranean (Limited)	5 0 0	5 0 0	3½ — 4
6000	5	Do. preference	5 0 0	7 0 0	.. — 5
30000	5	Oriental (Calcutta)	5 0 0	9 0 0	6½ — 7
30000	5	Do., new shares	1 0 0	9 0 0	1 — 1½
10000	5	Ottoman (Limited)	5 0 0	nil.	1 — 2½
10000	10	Pará (Limited)	10 0 0	6 0 0	8 — 9
27000	20	*Phœnix*	20 0 0	10 0 0	27½ — 28½
3600	100	Do., new	35 0 0	7 10 0	36 — 37
144000	8k.	Do.	100 0 0	5 0 0	72 — 74
5000	20	*Rateliff*	20 0 0	10 0 0	22½ — 23
	20	Rio de Janeiro (Limited)	20 0 0	10 0 0	23 — 25
6959	5	Singapore (Limited)	5 0 0	4 0 0	
2000	5	Do., preference	5 0 0	7 10 0	
		Shanghai			
4800	50	*South Metropolitan*	50 0 0	10 0 0	70 — 72
		Do., new shares	12½ 0 0	10 0 0	17½ — 18
15000	10	*Surrey Consumers*	10 0 0	10 0 0	12½ — 13
10000	10	Do., new	6 0 0	10 0 0	7½ — 8
9000	5	United General (Limerick)	5 0 0		2 — 2½
10000	10	*Victoria Docks*	5 0 0	6 0 0	
1500	10	*Wandsworth and Putney*	10 0 0	10 0 0	.. — 16
2989	10	Do.	10 0 0	7 10 0	
316	10	Do.	6 10 0	7 10 0	
1128	10	Do.	3 0 0	7 10 0	
20000	10	Western (Limited) A shares	10 0 0	10 0 0	14 — 14½
10000	10	Do., B shares	6 0 0	10 0 0	8 — 8½
10000	10	Do., C shares	6 0 0	10 0 0	8 — 8½
20000	10	Do., D shares	1 0 0	10 0 0	1½ — 2
8000	5	*West Ham*	5 0 0	7 10 0	.. — 7½
6000	5	Do., new shares	5 0 0	7 10 0	.. — 7½
551	10	West London Junction (Limited)	10 0 0	6 0 0	
520	10	Do., preference	10 0 0	6 0 0	

Price Current.

CASTINGS.—*Per Ton.*

Average Weight of Cast-iron Gas-pipes, per Yard.

1¼ in.	2 in.	2½ in.	3 in.	4 in.	5 in.	6 in.	7 in.	8 in.	9 in.	10 in.	12 in.
16	21	28	33	51	70	89	107	126	149	177	208 lb

Retail Prices are 5 to 10 per cent. higher.	London.	Glasgow.	Newcastle	Wales.	Yorkshire, Derbyshire, and Staffordshire.
	£. s. d.	£. s. d.	£. s. d.	£. s. d.	£. s. d.
Pig Iron, No. 1 (g.m.b.)	3 12 6	3 12 9	3 7 6	3 5 0	3 5 0
1¼ and 2-inch Socket-pipes	7 10 0	8 0 0	6 15 0	6 15 0	7 10 0
2½ and 3-inch ditto	7 0 0	6 0 0	6 5 0	6 10 0	7 0 0
4 and 5-inch ditto	6 10 0	5 10 0	5 15 0	6 0 0	6 10 0
6 inches and upwards ditto	6 5 0	5 0 0	5 10 0	5 15 0	6 5 0
Retorts, 1st fusion, hot blast	6 0 0	—	5 5 0	5 10 0	6 0 0
Ditto, 2nd ditto, cold ditto	7 0 0	5 15 0	5 15 0	6 0 0	7 0 0
Tank-plates, ¼ thick and above	6 10 0	5 10 0	5 10 0	5 15 0	6 5 0

WROUGHT-IRON TUBING,

Subject to 50 per cent. Discount.

	2 in.	1½ in.	1¼ in.	1 in.	¾ in.	½ in.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
Patent Welded Tubes, from 2 to 12 feet—per foot	1 8	1 0	0 10	0 7	0 5	0 4½
Ditto ditto, from 6 inches to 18 inches—each	3 0	2 0	1 9	1 3	1 0	0 9
Connecting-pieces, or Long Screws	3 6	2 3	2 0	1 6	1 2	0 11
Bends, Springs, and Elbows (wrought iron)	3 9	2 3	1 9	1 0	0 10	0 8
Tees, wrought or cast	4 0	2 6	2 0	1 8	1 1	0 10
Crosses, ditto	4 6	3 0	2 6	2 0	1 6	1 2
Iron Cocks	17 6	9 6	7 6	4 6	3 3	2 6
Ditto, with brass plug	28 0	16 0	13 0	7 0	5 6	4 6
Diminishing Sockets, Caps, Plugs, and Nipples	1 3	0 9	0 8	0 6	0 5	0 4
Plain Sockets	1 0	0 8	0 7	0 5	0 4	0 3
Syphons, 2-quart	15 0	14 0	13 6	13 0	12 0	—

GAS COALS.—*Per Ton.*

Newcastle.—Unscreened:—	
Haswells, Nettlesworth Primrose, and South Pelaw	6s. 6d.
Felling, Framwell Gate, North Pelton, Redheugh Main, Walker's Primrose, West Wear, and Whitwell Primrose	6 9
Burnhope, Craghead, Charlaw, Derwent, East Castle, Edmondsley, Eighton Moor, Hartlepool Pelaw, Holmside, Lambton's Gas, Lanchester Pelaw, Medomsley, Micklery, New Pelaw, Pelaw Main, Ravensworth, Seaham, South Moor Pelton, South Leverson, Townley Main, Tyne Main, West Pelaw, Wearmouth Hutton, and Witton	7 0
Penreth, Ravensworth Pelaw, Waldridge, West Garesfield, and West Pelton	7 3
Brancepeth, Dean's Primrose, Londonderry Gas, New Pelton, Pelton, South Peareth, Stella, Urpeth, Washington Hutton, and West Leverson	7 6
Ramsay's Newcastle Cannel	15 0
Wigan Cannel (at Liverpool)	17 0
Scotch Cannel:—	
Boghead (at Leith)	42 6
Muirkirk	27 0
Kirkness, best (at Burntisland)	28 6
Capeldrae, 1st quality (at ditto)	28 6
Ditto, 2nd ditto (at ditto)	18 6
Cowdenbeath	12 0
Lesmahago (at Glasgow)	31 6
Ditto (at Granton)	32 6
Arniston	27 6
Wemyss	27 6
Raywood, Wilsontown (at Granton)	23 0
Pirnie, or Methill	17 0
Lothian's Cannel (at Leith)	28 0
Myles' Cannel	23 6
Lochore Parrot (at Burntisland)	28 0
Lanemark (at Glasgow)	16 0
Elphinstone Tower (at Leith)	20 0

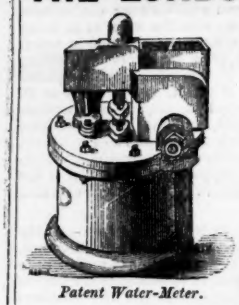
FREIGHTS.

Coastwise—Newcastle.—Per Ton:—	
Chatham and Rochester	5 6
Cork	8 0
Dover, Folkestne, & Ramsgate	6 0
Dublin	8s. to 8 6
Exeter Quay	7 6
Ipswich	4 6
London (from Leith)	7s. 6d. to 8 0
London (Pool)	5s. 6d. to 5 9
Lowestoft and Yarmouth	4 6
Portsmouth & Southampton	6 6
Plymouth	6s. 9d. to 7 0
Shoreham	6 6
Whitstable	5 6
Weymouth	6 6
Foreign.—Per Keel:—	
Barcelona	£18 0
Bordeaux	11 10
Boulogne and Calais	6 5
Cadiz	14 10
Cronstadt	—
Copenhagen	9 5
Genoa	£16 10s. to 17 0
Hamburg	7 10
Havre de Grace	8 0
Leghorn	16 10
Lisbon	14 10
Rotterdam	7 5
Stettin	10 0
Trieste	16 10
Venice	15 10

SUNDRIES.

Best Nettle Fire-bks., p. 1000, £2. 10s. to £2 15 0	
Cliff's Fire-bks. (at Wortley), p. 1000	2 15 6
Ingham's ditto (at Wortley), p. 1000	2 15 0
Fire-clay Retorts, p. ft. run, 8s. 6d. to	0 7 0
Tough Cake Copper, p. ton	98 0 0
English Pig Lead, p. ton	19 0 0
Welsh Bar Iron (in London), p. ton	6 5 0
Foreign Spelter, p. ton	20 5 0
English Block Tin, p. ton	86 0 0
Banca, p. ton	94 0 0
Tarred Rope Yarn, p. cwt.	1 0 0

THE LONDON & WESTMINSTER METER COMPANY, LIMITED.



Patent Water-Meter.

(SUCCESSORS to THOS. EDGE, Jr., & CO.)

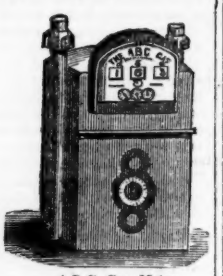
PATENTEES AND SOLE MANUFACTURERS OF

THE ABC GAS-METER.

EDGE'S PATENT INDEX.

PATENT WATER-METER (a Cylinder and Piston).

The ABC GAS-METER shows in plain figures the money payable for Gas consumed, as well as the number of cubic feet.



ABC Gas-Meter.

The WATER-METER is accurate in measurement, simple in action, and moderate in price.

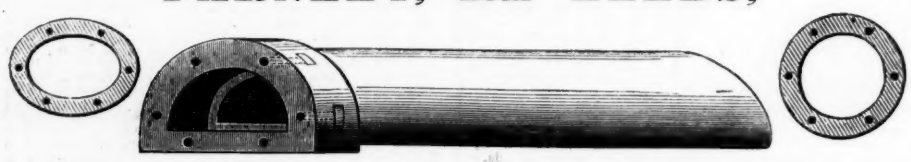
Manufacturers of the ordinary Wet and Dry Meters, Governors, Photometers, and all other Gas and Water Apparatus.

JOHNSON'S PLACE, LUPUS STREET, LONDON, S.W.

CITY OFFICE: 2, CASTLE COURT, BIRCHIN LANE, E.C.

THE FARNLEY IRON COMPANY,

FARNLEY, near LEEDS,



In consequence of the increasing demand for their Retorts, have largely extended this branch of their Fire-Clay Works, and are now prepared to execute the most important orders, either for *home* or *export*, with great punctuality.

The Fire-Clay raised from the Farnley Estate (commonly called the Wortley bed) is unsurpassed by any other known in the district, and is peculiarly well adapted for Retorts, Gas-Ovens, and Fire-Bricks; and the F. I. Co. beg especially to invite those connected with Gas-Works, who have not yet used their Retorts, to be good enough to favour them with a trial.

The F. I. Co. generally hold in stock, for immediate supply, Fire-Bricks of every size and kind—Tiles, Sanitary Tubes, Ornamental Terra-Cotta Ware White Facing Bricks, the White Buff, and Salt-Glazed Bricks, &c., &c.

Prices, Drawings, and all other information may be obtained by applying as above, or to

MR. SUTTON, THE HULL STORES, 46½, QUEEN STREET, HULL.

JOHN VICKARY,

GAS ENGINEER AND CONTRACTOR, IRON AND BRASS FOUNDER,

WORKS—EXE ISLAND, EXETER,

Tenders his best thanks to the various Gas Companies in **England, Ireland, and Wales,** for the very liberal and kind support he has received for the last **22 years,** during which period he has erected and extended above **200 Gas-Works.**

In addition to the numerous towns wherein he has been engaged, he begs reference to the following testimonial:—

Plymouth and Stonehouse Gaslight and Coke Company.

Sir,—I have much pleasure in testifying that the 100-foot Telescope Gasholder and Cast-Iron Tank, erected by you for this Company in 1862, has given the highest satisfaction, and never required the slightest attention or adjustment since its completion.

(Signed) PETER ADAMS, Chairman.

He has also erected a 100-foot Gasholder and Cast-Iron Tank at **Exeter;** an 80-foot Telescope Gasholder and Iron Tank at **Devonport;** a 90-foot at **Torquay,** &c. &c. At either of those works satisfactory references can be made.

He also begs particular attention to his **Improved Gas-Meters,** either **Wet, Dry, or Compensating,** the materials and workmanship of which guaranteed of the very best description, and which has gained for his Meters so excellent a reputation for these last **20 years.**

RETORTS, DIP & ASCENSION PIPES, HYDRAULIC MAIN, CONDENSERS, PURIFIERS, STATION-METERS, GOVERNORS, VALVES, and GASHOLDERS,

Of any size, and every description of article required in Gas-Works.

Mains, Tees, Connexions, and Syphons, from 2 to 12 in., always in stock, and supplied at Scotch prices.

Clay Retorts and Fire-Goods of every description.

Gas-Fittings of the most modern designs.

Iron Pipe and Fittings, Service Cocks, &c.

Plans, Specifications, and Estimate for the erection of New Gas-Works of any size furnished.

GAS AND WATER PIPES.

CLARIDGE, NORTH, & CO.,

BILSTON.

WANTED, as Manager or Manager and Secretary of Gas-Works. Practically experienced in the general routine of same. Book-keeping by double or single entry.

Address D. M., care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

TO GAS COMPANIES.

A Manager of 15 years experience is desirous of a re-engagement in a similar capacity, or as Manager and Secretary.

Address X., Messrs. Marlborough and Co., Ave Maria Lane, LONDON.

THE Directors of the Shrewsbury Gas Company are desirous of receiving applications for the office of METER INSPECTOR, &c. The person appointed will have to take the indices, water the meters, keep the fitting accounts, and make himself generally useful. Wages £1 4s. per week.

Applications to be made to the undersigned before the 9th day of July next.

S. B. DARWIN, Secretary and Manager.

WANTED, a good second-hand STATION-METER, capable of passing from 1000 to 1200 feet of gas per hour.

Apply to Mr. PARTINGTON, Gas Company, ST. ASAPH.

GAS EXHAUSTERS FOR SALE.—4 Beales Exhausters, 21 in. diameter, for 7-in connexions.

2 single-pump double-acting Exhausters, 21 in. diameter by 24-in stroke, without engines.

2 double-pump double-acting Exhausters, 17 in. diameter by 24-in. stroke, without engines.

The above are all in good order, having only been removed to make way for larger Exhausters, and will be sold cheap.

Apply to HANNA, DONALD, & WILSON, 9, Fenchurch Street, LONDON; and Abbey Works, PAISLEY, where they can be seen.

EAST BARNET GAS & WATER COMPANY.

TO be Disposed of, a quantity of useful surplus IRON GOODS, consisting of—

5 15-in. Mouthpieces, with lugs, lids, and cross-bars, &c.

4 Furnace-Frames and Doors.

14 Saddle-Pipes, Ascension-Pipes, Arch-pipes, and Dips, complete.

A 12-in. Hydraulic Main, 16 ft. long, for 14 dips.

2 strong Cast-iron Chairs for ditto.

A 3-in. Vertical Condenser, with 4 upright pipes, each 9 ft. 6 in. long.

A 3-in. Washer, 2 ft. 6 in. diameter, 17 in. deep.

2 Dry-Lime Purifiers, with middle partitions, 5 ft. square, 3 ft. deep; with iron trays, valves, and connexions for single or double working.

9 Wrought-iron "Buck Staves," 8 ft. long, 4½ in. by 4 in.

13 (nearly new) 15-in. Circular Mouthpieces.

2 (nearly new) 12-in Circular Mouthpieces.

12 D-shaped Circular Mouthpieces, sizes varying from 9 in. to 15 in.

May be seen on the works, as above, on application to Mr. WILLIAM C. HUMPHRYS, Manager and Secretary, New Barnet, HERTS.

GAS TAR & AMMONIACAL LIQUOR FOR SALE.

THE Directors of the Dudley Gas Company invite TENDERS for the surplus TAR and AMMONIACAL LIQUOR to be produced at their works for one year, ending June 30, 1869. The quantity of Tar will be about 50,000 gallons and Liquor 150,000 gallons.

Tenders to be sent in not later than the 21st inst.

The Directors do not bind themselves to accept the highest or any tender.

Gas-Works, Dudley, July 1st, 1868.

THE Directors of the Over Darwen Gaslight Company are prepared to receive TENDERS for the supply of the best COAL, delivered free at the Over Darwen Railway Station.

Particulars may be known on application to the undersigned.

Tenders to be sent in, addressed to James Shorrock, Esq., Chairman to the Company, not later than July 27, 1868.

RICHARD GREEN, Engineer and Manager.

THE Directors of the Over Darwen Gaslight Company are prepared to receive TENDERS for the supply of the best mixed CANNEL, delivered free at the Over Darwen Railway Station.

Particulars may be known upon application to the undersigned.

Tenders to be sent in, addressed to James Shorrock, Esq., Chairman to the Company, not later than July 27, 1868.

RICHARD GREEN, Engineer and Manager.

TO CONTRACTORS FOR PIPE LAYING.

THE Leicester Water-Works Company are prepared to receive TENDERS for the laying of about 5 miles in length of Cast-iron SOCKET-PIPES, of 20 in. and 24 in. diameter respectively.

Specifications may be seen, and printed forms of tender may be had, on application at the Office of the Company, in Leicester, or at the Office of Messrs. Thomas and Charles Hawksley, 30, Great George Street, Westminster, S.W., on and after Wednesday, the 1st of July next; and tenders must be delivered at the Office of the Company on or before Tuesday, the 21st of July next.

The Directors do not pledge themselves to accept the lowest or other tender.

By order,
J. H. WILLIAMS, Secretary.

Leicester, June 23, 1868.

TO GAS ENGINEERS AND CONTRACTORS.

TENDERS are required by the Moreton Hampstead Gaslight, Coal, and Coke Company, Limited, for the supply of all Materials, Labour, Tools, Implements, and every other requisite for the erection of Gas-Works complete at Moreton Hampstead, in the county of Devon, together with all the earthwork, brickwork, masonry, concrete, puddle, ironwork, and all necessary apparatus, machinery, pipes, mains, working tools, and plant proper for a gas-works establishment capable of supplying 300 lights during each evening's consumption.

Tenders to contain also a schedule of prices for such pipes, fittings, apparatus, and works as may be necessary between the mains and the outlets of the meters when fixed on the consumers premises, and which are not intended to be included in the lump sum contract.

Persons desirous of tendering may obtain further information by applying to Mr. W. P. HARVEY, the Secretary to the Company, at Moreton Hampstead, Devon, to whom the tenders are to be sent on or before Saturday, the 18th of July inst.

The Company do not bind themselves to accept the lowest or any tender.

Moreton Hampstead, July 1, 1868.

CRYSTAL PALACE DISTRICT GAS COMPANY.

TAR, SULPHATE OF AMMONIA, & BREEZE.

TENDERS are requested for the purchase of the TAR, SULPHATE OF AMMONIA, and BREEZE produced at this Company's works for one year, from the 1st of July, 1868, to the 30th of June, 1869. Particulars as to quantities, &c., and samples as to quality can be had on application to Mr. E. S. Cathels, the Company's Engineer.

Tenders to be addressed "to the Chairman," and sent to the Offices of the Company, at the Works, Lower Sydenham, S.E., on or before Thursday, the 9th of July. By order of the Board,

MAGNUS OHREN, Secretary.

"SAINT IVES (HUNTS) IMPROVEMENT ACT, 1847."

LIGHTING WITH GAS.

THE Commissioners acting under and in execution of the above-mentioned Act will be prepared at their monthly meeting, to be held in the Corn Exchange, in St. Ives, Hunts, on Thursday, the 6th day of August next, at Ten o'clock in the forenoon, or at some adjournment thereof, to enter into a CONTRACT with any Company or person willing to supply and light the Streets, Roads, and other Places within the limits of the above-mentioned Act with GAS for a period of Three Years, from the 1st day of July, 1869.

The present number of public lamps is 74, and the season for lighting is from the 1st of September to the 1st of May.

Persons willing to undertake the same are invited to send in tenders for that purpose, so as to be received by us on or before Wednesday, the 5th day of August next; and the tenders must not only specify a fixed sum per lamp per annum, including lighting, extinguishing, cleansing, and repairs, but also the price per 1000 cubic feet, to be ascertained by test meters.

Persons tendering are also requested to state the maximum price per 1000 cubic feet to be charged to private consumers.

The person or Company whose tender shall be accepted will be required to enter into a contract and bond, with sureties, containing stipulations as to the mode of payment, quantity and quality supplied, penalties for not lighting, &c., a copy of which can be seen at our Offices. And any further information which may be required will be furnished on application being made to us either personally or by letter.

The Commissioners do not bind themselves to accept the lowest or any tender.

FISHER AND GINN,
Clerks to the Improvement Commissioners.

St. Ives, Hunts, June 23, 1868.

TO TAR DISTILLERS, &c.

THE Directors of the Independent Gaslight and Coke Company invite TENDERS for the whole of the TAR produced on their works at Haggerston for one year, from the 1st of August next.

Tenders, accompanied by references, must be sent in to me not later than Wednesday, the 15th of July.

By order,
JAMES B. COULSON, Secretary.

Offices, 236, Kingsland Road, N.E.,
June 29, 1868.

IMPROVED WATER DISTRIBUTOR.

TO THE EDITOR OF THE "JOURNAL OF GAS LIGHTING."

Pioneer Iron-Works, Accrington, June 22, 1868.

DEAR SIR,—We have constructed a self-moving Water Distributor for Scrubber use, which for simplicity, durability and efficiency cannot be improved, and we should be glad to supply it to any of your readers with a guarantee that its working gives every satisfaction. Yours truly,

PETER EDDLESTON & Co.

[COPY TESTIMONIAL.]

Gas and Water Works, Accrington, June 20, 1868.

GENTLEMEN,—I have great pleasure in bearing testimony to the very efficient, simple, and durable self-moving Water Distributor that you have fixed in the Scrubber at these works, and I have not the slightest hesitation in saying that its working will give entire satisfaction to the purchaser.

I am, Gentlemen, yours truly,
ROBERT IDDON,
Secretary and Manager.

Messrs. Peter Eddleston & Co.,
Pioneer Iron-Works, Accrington.

NOTICE.

Suffolk Street, Clerkenwell Green, London, June 24, 1868.

As sole Executrix of the late Mr. Thomas Glover, permit me to inform you that I have taken into Partnership his brother, Mr. John Glover, who for upwards of 20 years has had the sole management of the Manufacturing Department, and I have secured the services of the same efficient staff of skilled workmen who have for so many years been connected with the Establishment, which I trust will be a sufficient guarantee that the article manufactured will maintain its well-known high character.

All orders that you may be pleased to forward shall receive the same prompt and careful attention as heretofore.

The business will be still conducted under the style and title of "Thomas Glover," and will shortly be carried on at the extensive new factory erected by the late Mr. Glover, in St. John Street, Clerkenwell Green, which his enlarged business rendered requisite.

I am, yours truly,
AGNES R. GLOVER.

Referring to the annexed letter, I beg to say I have entered into Partnership with Mrs. Glover, the widow of my late brother, and respectfully solicit a continuance of your esteemed orders, which shall at all times command my best attention.

Yours respectfully,
JOHN GLOVER.

TO GAS COMPANIES.

WESTPHALIAN GAS COAL, yielding 10,000 cubic feet of 18-candle gas, and good COKE, can be supplied at 19s. per ton, ex ship in Thames, by WARNER, WALDUCK, and Co., 11, OLD JEWRY CHAMBERS, E.C.

Sole Agents in England for Hamilton, Dullens, & Co.

GANISTER.—This valuable material which is found to be the best adapted for the lining of furnaces and cupolas in refineries, glass and chemical works, and GANISTER CEMENT for gas-works, specially prepared for setting and patching retorts, can be supplied in any quantity by WARNER, WALDUCK, and Co., No. 11, Old Jewry Chambers, LONDON, E.C.

CANNEL COAL.—The West Yorkshire Iron and Coal Company, Limited, beg to draw the attention of Gas Companies to their Cannel, of which the following is the analysis made by W. Huggon, Esq., F.C.S.:—

Yield of gas per ton	10,296 cubic feet.
Illuminating power rather over	21 sperm candles.
Yield of coke per ton . . .	12 cwt.

The actual working, as reported by one of the largest gas companies in Yorkshire, gives results still more favourable, viz—

Yield of gas.	10,416 cubic feet.
Illuminating power . . .	21·89 sperm candles.
Coke	The same.

We add from the same source the capabilities of the common gas coal—

Yield of gas.	10,080 cubic feet.
Illuminating power . . .	14·41 sperm candles.
Yield of Coke	13 cwt.

COLLIERIES—WEST ARDSLEY, near LEEDS.

For further particulars, address to the Office of the Company, 15, York Place, LEEDS.

POPE & PEARSON'S Gas Coal.—We beg to call the attention of all Gas Companies to this important winning, at a depth of 1275 feet. The yield of gas is more than 10,000 cubic feet per ton, with an illuminating power of 20 spermaceti candles, producing 12¼ cwt. of coke per ton The Coals are now being used by the Gas Companies in London. One Engineer, after trial, gives the following results:—

10,000 cubic feet per ton, and			19·13 candles.
11,468	,,	,,	16·57 ,,
12,000	,,	,,	15·42 ,,
13,260	,,	,,	15·00 ,,

This valuable Coal can be delivered in London within 1s. per ton of the ordinary Newcastle Gas Coal; can be shipped at the ports of Hull and Goole, or by railway to any station.

For further particulars, apply to POPE AND PEARSON, West Riding and Silkstone Collieries, near Leeds, YORKSHIRE.

LAMBERTS

PATENT GALVANIZED IRON COCKS,

WITH WHITE METAL PLUGS.

TRADE (L) MARK.

Warranted not to corrode or set fast, and are 50 per cent. cheaper than Brass Cocks.

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Manufacturers,
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DRY GAS-METERS IN CAST-IRON CASES,

MANUFACTURED BY

WILLIAM AND BENJAMIN COWAN,

(ESTABLISHED 1827,)

BUCCLEUCH STREET WORKS, EDINBURGH,

Possess a simplicity of construction and facility for repair greater than any yet produced, while the excellence of the material and workmanship, and accuracy of registration, cannot be surpassed. The superiority of their Dry Meters in Tin Cases is also well known.

SOLE MANUFACTURERS OF

ESSON'S PATENT COMPENSATING GAS-METERS.

COWAN'S PATENT SIDE-VALVE GAS-METERS.

TO CORPORATIONS, GAS ENGINEERS, AND OTHERS.

HENRY ALDER,

GRANGE METER-WORKS, EDINBURGH,

Begs to intimate that he is the ORIGINAL MANUFACTURER of

DRY GAS-METERS IN CAST-IRON CASES.

The Meters are protected by Registration on the 17th of December, 1864, under the "Copyright of Designs Act."

They are much more durable, and at the same time more easily repaired than those in Tin Cases.

PRICE LIST AND TERMS ON APPLICATION.

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PATENTS FOR CHARGING AND DRAWING GAS-RETORTS,

WITH CHAMBERS FOR MOUTHS,

REQUIRING NO LUTING.

Gas Engineers are solicited to examine into the merits of this invention before erecting new or altering old retort-houses. It may be seen in action at the Alliance Gas Company's Works, Dublin, where its utility and economy will be clearly demonstrated. Although the saving in labour will be considerable, and quickly return any outlay of capital, there are other and important features strongly recommending its adoption at all gas-works, and which a gas engineer upon examination will at once appreciate.

The Directors of the Alliance Gas Company have kindly consented to give every facility to gentlemen desirous of seeing the invention in operation. Parties, therefore, about to visit Dublin will be so good as to send us their card, and we will furnish them with letters of introduction.

Drawings, &c., may be seen at our Office, and all details explained.

JOHN CHISHOLM, SON, & CO., 44, MARK LANE, E.C.

CATHELS'S Patent Dry District GOVERNOR is the only perfect self-acting contrivance for regulating the pressures in the higher levels of a district.

CATHELS'S Patent Four-way Disc GAS-VALVE—ONE OF WHICH SERVES AS THREE ORDINARY VALVES—is the best Valve for gas-works.

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Apply to Messrs. BROGS & SON, 37, Southampton Street, Strand, LONDON.

TESTIMONIAL.

Abingdon Gaslight and Coke Company, Limited, Offices and Works, Thames Street, June 25, 1868.

Mr. E. S. CATHELS.

Sir,—We have recently relaid a great portion of our town with your Patent Pipe, and I have much pleasure in bearing testimony to its merits. I find from our fitters that there is not the tendency to split when large services are put in that we find in the ordinary pipe of the smaller sizes, and, from having a greater thickness to drill and tap into, there is less liability to leakage at the connexion.

I am, sir, yours respectfully,

JOHN TOMKINS, Chairman.

OXIDE OF IRON,

We are prepared to supply, on moderate terms,

HYDRATED PEROXIDE OF IRON (BOG OCHRE),

Same quality as supplied by us to several of the most extensive Gas Companies, and which has given entire satisfaction.

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WOLVERHAMPTON RETORT WORKS.

ESTABLISHED 1840.

JOHN EUNSON AND SON,

GAS ENGINEERS, AND MANUFACTURERS OF CLAY RETORTS,

AND FIRE GOODS IN GENERAL,

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Retort Mouthpieces, Bolts, Nuts, and every description of Wrought-Iron Work.

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MR. W. H. BENNETT, having had considerable experience in matters connected with Gas, Water, and Sanitary Improvement, begs to say that he continues to assist Inventors in the perfection of their designs, and to obtain for them PROVISIONAL PROTECTION, whereby their invention may be secured for Six Months; or LETTERS PATENT, which are granted for Fourteen Years.

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PURIFIERS, CONDENSERS, and SCRUBBERS erected complete, or the materials supplied; with every description of goods in use by Gas-Works, in stock, on wholesale prices, at

Mr. LYNCH WHITE'S,

Old Barge Iron Wharf, Upper Ground Street,

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FIRE-CLAY GAS-RETORTS, &c., CANNEL AND STEAM COALS.

WILLIAM FRASER, Inverkeithing (owner of the Works at which Fire-clay Retorts were first made), having greatly enlarged his works, can supply retorts and other fire-clay goods to any extent.

References can be given to managers of above a hundred Gas-Works whom he supplies.

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IMPROVED

WOOD SIEVES FOR GAS PURIFIERS.

WORKS:

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MR. ANDERSON advises Companies on all matters connected with the manufacture of Gas and the construction of Works.

PATENTEE and MANUFACTURER of the following Inventions:—

RETORT SETTINGS, heated by tar without the production of smoke.
STEAM-ENGINES and **EXHAUSTERS**, separately or combined.
FOUR-WAY VALVES, one of which is equal to three ordinary Valves.
STATION GOVERNORS—the Gasholder cannot tilt and cause accident.
BREEZE AND TAR FUEL MACHINE.

A Pamphlet containing Eighteen Illustrations of the foregoing, with letterpress on the construction of Works, post free, 2s. 6d.

N.B.—The second edition of this Work, *now ready*, contains illustrations of the Machine for converting Breeze and Tar into Fuel for heating the Retorts.

"The Author is well qualified to speak authoritatively upon the important subjects to which his pamphlet refers."—*Artizan.*

TO MANAGERS OF GAS-WORKS.

MANN'S IMPROVED SCRUBBER.

See Description and Sketch in "JOURNAL OF GAS LIGHTING," March 31, 1868.

MESSRS. WESTWOOD & WRIGHTS are prepared to submit estimates for the supply and erection complete of the above, either in London or the Provinces.

MESSRS. W. & W. have already constructed several, which are now in successful operation, and give great satisfaction.

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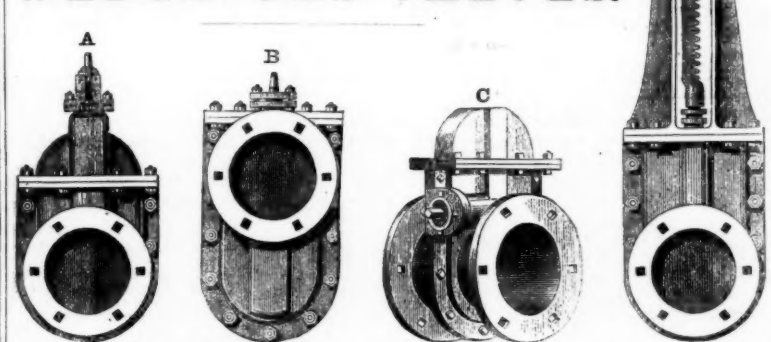
HOPE BOILER & GASOMETER WORKS,
BRIERLEY HILL, STAFFORDSHIRE, NEAR DUDLEY.

C. & W. WALKERS'
WEDGE GAS-VALVES.



These justly celebrated and well-known Gas-Valves of the most perfect workmanship and construction are made at as low a price as any other kind.

A—Above-ground Screw Gas-Valve, with improved indicator to show when open and shut, is the best kind of Valve for heavy pressures, such as the oxide of iron purification.
B—Under-ground Screw Gas-Valve.
C—Internal Rack Gas-Valve, with wrought-iron pinions.
D—Ordinary Rack and Pinion Valve, with strong undamageable racks and pinions.

MIDLAND IRON-WORKS,
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PURIFICATION OF GAS.

FRODINGHAM IRONSTONE MINES,
NEAR
BRIGG, LINCOLNSHIRE.

Gas Companies can be supplied from these Mines with OXIDE of IRON, for the purification of Gas, on reasonable terms, and in any quantity that may be required.

This material is a natural Oxide, and is supplied to Gas Companies as taken from the Mines, without any admixture of deleterious matter. It acts freely, and will purify a much larger quantity of gas per ton, than the generality of the material now in use under this name.

It will be found highly beneficial in large establishments, where they are liable to be called upon occasionally to make a much greater quantity of gas than usual, as well as in small establishments where they are limited in space, as by its adoption a much larger quantity of gas can in much less time be purified with the same quantity of material.

Apply to Mr. JAMES SHERWOOD, at the Mines; or to Mr. LIVESEY, 6, Victoria Street, WESTMINSTER, London Agent.

NO NECESSITY
FOR
CANNEL COAL
If POPE and PEARSON'S GAS COAL is used.

WEST RIDING AND SILKSTONE COLLIERIES,
NEAR LEEDS.

NINETEEN YEARS PRACTICAL EXPERIENCE.

EDWIN BENTLEY,
RETORT SETTER,
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YORKSHIRE.

Fire-Clay and Iron Retorts, Double and Single Grooved Brick Retorts, of every description.
Bentley's Improved D Brick Segment Retorts, 5 or 3 in one bed.
Testimonials and references on application.

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Manufactory for every description of Casting and Machinery for Gas-Works and Water-Works.
Warehouse in London for Cast-iron Pipes and Connexions of all sizes and in any quantity, Scott's Wharf, Bankside, Southwark.
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TO GAS AND WATER COMPANIES.

SECOND-HAND
FIRE AND BURGLAR PROOF
SAFES.

BEFORE PURCHASING SEND FOR
GRIFFITHS' MONTHLY LIST OF SAFES,
By Milner, Marr, Thos. Perry and Sons, Mordan, Price, Whitfield, and every eminent maker, at about half the price of new.
A guarantee given with each.
A large quantity of TANN'S SAFES from £2 10s.
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These Retorts are now used at more than 60 Gas-Works, and continue to give satisfaction.
The Iron Retort is recommended for great durability. The Clay Ovens and Retorts obtain a more speedy and perfect carbonization of the Coal.
To ensure the excellence of the Brick Ovens and Fire-Clay Retorts, the Patentee has made arrangements with the following makers for their supply:—
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FIRE-BRICKS, LUMPS, SQUARES, and TILES of all dimensions.
GAS-RETORTS always in stock.
GARDEN EDGINGS of various patterns.
ORNAMENTAL BUILDING BRICKS.
GRATE BACKS in various designs.
Contracts entered into to set Retorts, erect Furnaces, &c.
Shipments on the shortest notice.
Makers of A. C. FRASER'S Patent Ribbed Retorts and Brick Ovens.

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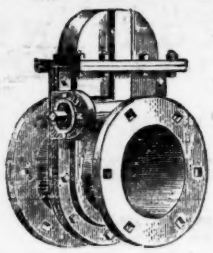

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These Valves are all proved on both sides to 30 lbs. on the square inch before leaving the works, and are always kept in stock.
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Manufactory—Broad Street, Birmingham—Established 1807,
MANUFACTURERS OF GLASS CHANDELIERS, GLASS LUSTRES, TABLE GLASS, &c. &c.
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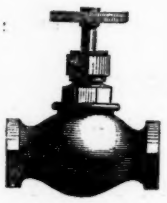

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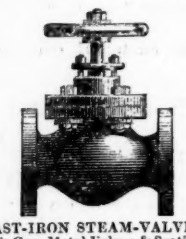
Bore.	Price.
¾ inch	£0 4 0
⅞ ,,	0 4 6
1 ,,	0 6 0
1 ,,	0 8 6
1¼ ,,	0 11 0
1½ ,,	0 14 0
1¾ ,,	0 18 0
2 ,,	1 2 6



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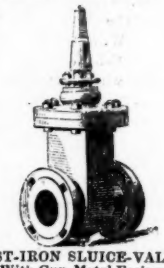
With Gun-Metal Valves & Seatings.

Bore.	Price.
2 inches	£1 2 6
3 ,,	1 17 6
4 ,,	2 15 0
5 ,,	3 15 0
6 ,,	4 17 0
7 ,,	6 0 0
8 ,,	7 5 0
9 ,,	8 15 0
10 ,,	10 10 0
11 ,,	12 5 0
12 ,,	14 0 0



CAST-IRON SLUICE-VALVES.
With Gun-Metal Facings.

Bore.	Price.
2 inches	£1 10 0
3 ,,	2 5 0
4 ,,	3 0 0
5 ,,	3 16 0
6 ,,	4 14 0
7 ,,	5 14 0
8 ,,	6 16 0
9 ,,	8 0 0
10 ,,	9 6 0
11 ,,	10 14 0
12 ,,	12 4 0

Prices and particulars of all other forms and sizes can be had on application.

ROBERT DEMPSTER,
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R. D. recommends his Fire-Brick Retorts to Engineers and Managers of Gas Companies; they last from 10 to 12 years.

Iron and Fire-Clay Retorts.
Annular and Pipe Condensers.
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1867.

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STATION METERS for GAS-WORKS, CONSUMERS METERS, GOVERNORS,

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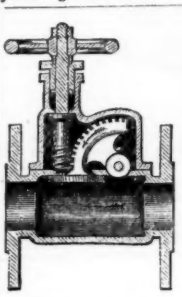
EXHAUSTER REGULATORS, &c.

N.B.—The flanges of the plates for the Square Station-Meters are planed so as to ensure perfect joints—guaranteed not to leak.



WARNER'S

NEW PATENT

QUADRANT-MOTION SLUICE or GAS VALVE.

It will be seen, by reference to the drawing, that by this simple method a clear water-way is obtained, the disc being drawn by the screw or worm entirely out of the way; thus all the advantages of the ordinary sluice-valve are obtained at much less cost, and the liability to set fast and get out of order entirely obviated. They are adapted for all purposes for hot or cold water, and equally suited for high or low pressure; and in case of need of repair, a new valve-seat can be applied without removing the body or case of the valve.

Particulars of the Quadrant Valve, also of Hydraulic Machinery, High or Low pressure Cocks, Water Closets, Gas-fitting in all its branches, and general Plumbers' Brass work, can be obtained upon application to

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(Brass and Bell Founders to Her Majesty,)

HYDRAULIC ENGINEERS.

SCHOLL'S

PATENT PLATINUM

GASLIGHT PERFECTER.

Extract from Report by Dr. Letheby:—

"The results have been very remarkable, for they show an average increase of 63 per cent. on the illuminating power of the gas. I am of opinion, therefore, that the invention is of great practical value."

Price 1s. each for Fish-tail Burners.

To be had retail of Gas-Fitters and Ironmongers, and wholesale of

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LONDON, W.

Terms on application. N.B.—A specimen sent free on receipt of Twelve stamps.

*** Further testimonials from Drs. Frankland and Crooks, showing the great practical value of this invention, will be shortly published.

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GAS ENGINEERS,

Gas-Meter, Gas Apparatus, and Gasfittings Manufacturers,

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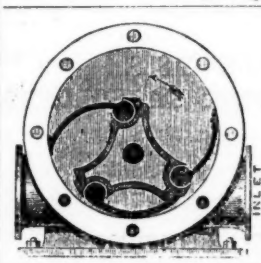
Station-Meters, Governors, Consumers Meters, Gas Lustres, Chandeliers, Brackets, &c., and every description of Gasfittings and Gas Apparatus.



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(From 250 Feet to 200,000 Feet per Hour.)

Also,

ROTARY TAR, OIL, AND LIQUOR PUMPS.

For particulars and prices apply to the Patentee,

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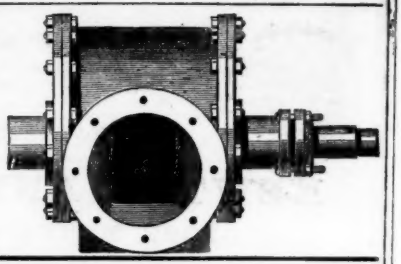

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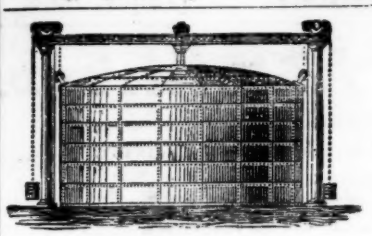

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